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A descriptive analysis of the public agricultural research and extension systems in Jamaica: A case study

Scott, Clive Robert, Ph.D.

The Ohio State University, 1993
A DESCRIPTIVE ANALYSIS
OF THE PUBLIC AGRICULTURAL
RESEARCH AND EXTENSION SYSTEMS
IN JAMAICA: A CASE STUDY

DISSERTATION
Presented in Partial Fulfillment of the Requirements for
the Degree of Doctor of Philosophy in the Graduate
School of The Ohio State University

By

Clive Robert Scott, B.S., M.S.

* * * * *

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CHAPTER I

PROBLEM IDENTIFICATION

The weak link between agricultural research and extension systems in Third World countries is generally recognized as a major setback to agricultural technology systems (Sands, 1988). Carey (1987) notes that one of the greatest deterrents to technology transfer throughout the world is the lack of true interaction among research, information, and extension components. These groups are often viewed as separate bodies with different purposes, often operating in isolation of each other.

Farner, Swanson and Bahal (1990) state that a major issue in the agricultural development field concerns strengthening the linkage between research-extension, particularly given the heavy emphasis on technology transfer in many countries. Similar studies by Amon (1989), Tchouamo (1986), and Rivera and Shram (1987) show that a major problem facing extension services in Third World countries is a lack of appropriate research compounded by deficient linkages between research and extension.

Donor countries and policy makers argue that weak links between research and extension are a major factor limiting technological change in developing countries (World Bank, 1985). Feliz (1989) showed that the link between the
research-extension systems in the Dominican Republic is inadequate. Extension agents do not have easy access to technology generated by the research system and the communication network is unclear.

The basic premise of this study is that research and extension systems should not be seen as separate entities, but should be closely linked. Researchers involved in applied and adaptive research, together with subject matter specialists, extension agents, and farmers should be seen as a team working together to improve the process of agricultural development. This interweaving of duties imparts more meaning to the entire technology transfer process to all participants and encourages a more effective team effort (Carey, 1987). Kaimowitz (1991) notes that to ensure relevance to research, extension agents and researchers should work together in identifying research problems and provide feedback about the technologies developed by researchers.

Studies conducted by the University of Kentucky (1979) and Rivera (1988) confirm the existence of linkage problems between research and extension in the Jamaican agricultural technology system. The Jamaican research and extension systems coordinate field days and develop some joint research activities, but discussions with researchers and extensionists reveal that the linkages between both systems are weak and inadequate.

The services provided by the Jamaican subject matter specialists (SMSs) are inadequate and limited to special requests made by field staff. Currently, three SMSs are employed by the Jamaican extension service. Functional linkages between
research-extension are weakly established and the extension system is not well informed of on-going research activities by the research system.

To improve the agricultural technology system in Jamaica, specifically the link between research and extension, scientific research is needed. This information is needed to determine the strengths and weaknesses in the technology system and to promote the need for improvement in the linkage process.

**Problem Statement**

Although both the research and extension systems are formally located in the Jamaican Ministry of Agriculture, they are separate public institutions with different mandates, organizational structures, and operational procedures. No explicit government policy exists explaining research objectives and linkages between research and extension, thus linkages between researchers and extension staff are mainly informal and based on personal contacts (Rivera, 1988). Even though strong linkages between research and extension are widely recognized in many countries (Baxter & Thalwitz, 1985), no formal mechanism is in place in Jamaica to bring researchers and extension personnel together on a regular basis to discuss research and extension objectives that would be of mutual benefit.

Extension agents are rarely aware of recent research findings and many extension recommendations remain unchanged for several years. Therefore, the problem addressed in this study is the lack of linkages between research and
extension in Jamaica and to promote the need for greater interaction. The lack of effective links has especially hindered the development and transfer of technology to small producers engaged in hillside farming and those in the upland regions of Jamaica. Researchers do not receive enough information about these farmers and their conditions and resources to conduct appropriate research.

Rivera (1988) noted that the linkages that once existed in Jamaica through the SMSs appear to be irregular, haphazard, and are usually based upon requests made by extension agents. For example, the SMSs need to collaborate regularly with the research centers and specialized extension programs to keep up to date with new technology.

To date, very little has been done to determine whether personnel in research and extension communicate about research and extension matters, the kind of feedback strategies used between the two systems, the collaboration on research objectives pertaining to farmers' needs, researchers' knowledge of farmers' use of new and improved technology, and the kinds of linkages needed between research and extension for the two systems to operate effectively. To answer these questions requires an empirical study.

**Purpose of the Study**

The purpose of this study was to describe and analyze the public agricultural research and extension systems in Jamaica focusing on the linkages between the two
systems. An important element to the success of any extension organization is the linkages that exist between the extension organization and sources of knowledge and technology. In analyzing the agricultural technology system in Jamaica, the study will focus on research and extension linkages. The rationale for this integrated approach is that if the Ministry of Agriculture extension agents are involved or at least kept informed about research activities, then they will be more knowledgeable and confident of new technologies and recommendations developed and thus more committed to the transfer and diffusion of new technology (Ewell, 1990).

**Objectives**

In analyzing the Jamaican research and extension systems, the indicators proposed by Swanson & Peterson (1989), in their Analytical Framework, were used to develop the objectives of the study. The specific objectives of the study were to:

1. Determine access to external sources of knowledge and technology by Jamaican agricultural researchers.

2. Assess personnel resources for the public agricultural research system in Jamaica.

3. Assess Jamaican resource allocations to research salaries and programs.

4. Describe public research allocations to commodity research.

5. Determine Jamaican Extension agents' access to and availability of internal technology from agricultural research in Jamaica.
6. Assess human resources for the public agricultural Extension system in Jamaica.

7. Examine personnel evaluation and supervision for the Jamaican public Extension system.

8. Determine the time allotted by Jamaican Extension agents to the transfer of agricultural technology.

9. Assess allocation of financial resources between Extension salaries, programs and capital investment in Jamaica.

10. Describe the types of technology transfer activities used by Jamaican Extension agents.

Significance of the Study

The main purpose of this study was to describe and analyze the Jamaican agricultural technology system, specifically the linkage between research and extension. Studies have shown that one of the critical elements for the success of any agricultural technology system is the linkages between research and extension. Pickering (1985) and Venkatesen (1985) noted that the link between research and extension is widely recognized as one of the most important institutional problems to be solved in developing an effective research and extension system. Without strong linkages between research and extension, technology will not flow effectively from the extension system to the farmers, nor will the farmers be able to provide feedback to researchers (Blackenburg, 1984).
The findings from this study will benefit Jamaican agricultural professionals (i.e., researchers and extension personnel) in the following ways:

1. Extension agents and researchers will recognize the importance of linkages between research and extension and how these linkages will enhance the transfer of agricultural technology.

2. Specific recommendations from this study may encourage the Ministry of Agriculture to institutionalize the linkages between research and extension.

3. The findings may provide evidence for the Ministry of Agriculture to justify greater resource allocations to the linkage aspect of the agricultural technology system.

5. The findings may also encourage Extension agents as well as researchers to communicate more frequently and view their role as a united effort in the development and dissemination of new technology.

6. The outcome of the research will highlight the strengths and weaknesses of the public Extension and research systems in Jamaica with a view toward improvement.

Assumptions

The assumptions of the study are based on the concept of the linkage between research and extension as a possible unifying and integrating idea. This integrated
approach can be accomplished by working together rather than as isolated entities (Havelock, 1977; Cummings, 1981; Carey, 1987; Roling, 1990; Ewell, 1990).

The underlying assumptions of this study are:

1. Strong linkages between the Jamaican research-extension systems will improve coordination in extension-research planning activities and programs.

2. Strong linkages between the Jamaican research-extension systems will lead to greater utilization of limited resources.

3. Strong linkages between the research-extension systems in Jamaica will improve communication channels and enhance the dissemination of new technology.

4. Strong linkages between the Jamaican research-extension systems will allow researchers and extension agents to work together in developing new technologies that are practical and useful to the farmer or intended audiences.

5. If the research-extension-farmer linkages are strengthened, then the research and extension systems will be better able to understand small-farmer problems.
**Definition of Terms**

For the purpose of this study, the following terms were operationally defined:

*Human Resources*: Human resources (i.e., extension agents, administrators, researchers) are limited to the public human resource base supporting agricultural development in Jamaica provided by the Ministry of Agriculture.

*Public Agricultural Research System*: The national agricultural research system which is formally located within the Research and Development Division of the Jamaican Ministry of Agriculture. The major focus of the national research system is to develop new technology for small farmers who are primarily responsible for growing crops and rearing livestock for domestic consumption (e.g., yam, corn, and poultry).

*Public Extension System*: The public technology transfer system of the Jamaican Ministry of Agriculture: the Rural Agricultural Development Authority (RADA). Its mandate is primarily to serve small and medium-size farmers in the rural areas in an effort to enhance their productivity and income, while at the same time fostering the development of rural infrastructure and improvement in farm family social needs. RADA activities are primarily centered on agricultural commodities raised for domestic consumption.

Other institutions (e.g., The Coffee Industry Board, The Coconut Industry Board, The Banana Board) in Jamaica also provide extension and research type services. Their mandate is primarily to serve large farmers whose emphasis is on
export commodities. This study will focus only on the public research and Extension systems.

*Researcher:* A person employed by the Ministry of Agriculture to conduct research that is applicable to Jamaica.

*Extension Agent:* An officer employed by the Ministry of Agriculture for the purpose of disseminating agricultural research innovations primarily to small farmers in Jamaica. In this study, extension agents also included agricultural assistants.
CHAPTER II

REVIEW OF LITERATURE

Introduction

The purpose of this chapter is to present an overview of literature and research related to the link between research and extension and the theoretical background of the study. This chapter will include a discussion of the Analytical Framework, the technology transfer process, the concept of linkage, and the linkage between research and extension.

The Analytical Framework

The purpose of this section is to provide an overview of the Analytical Framework. The Framework served as guide for the research and provided the conceptual foundation for the study of the public research and extension systems in Jamaica. The following topics will be discussed: a) the USAID/INTERPAKS Agreement, b) a general description of the Framework, c) an explanation of the flow...
analysis, d) an outline of the procedural steps and operational phases of the Framework, and e) a review of the main criticisms of the Framework.

**USAID/INTERPAKS Agreement**

In 1984 a five-year agreement was signed between the United States Agency for International Development (USAID) and the International Program for Agricultural Knowledge Systems (INTERPAKS). The USAID-INTERPAKS Cooperative Agreement was established to encourage the study of the development, transfer, and utilization of agricultural technology. The original Agreement was based on the assumption that technological change is critical to sustained agricultural development. Increasing and supporting the flow of appropriate agricultural technology to small farmers is an underlying goal of the Agreement.

The Agreement had three major objectives: a) to create a functional model of technology development, transfer, and utilization, b) to refine the model using a group of comparative case studies of agricultural technology systems in selected countries, and c) to obtain a set of concepts that could be used to evaluate the strengths and weaknesses of a technology system or parts of the system for the purpose of improved agricultural development. An expected outcome of the Agreement was the development of a practical instrument for diagnosing constraints in agricultural technology systems. During the next five years, an interdisciplinary research team developed and refined a diagnostic instrument to achieve the stated objectives. The instrument is referred to as the Analytical Framework.
General Description of the Framework

The Framework consists of three basic parts: a) an *a priori* systems macro-model, b) a set of methodological tools (i.e., indicators and measures) for collecting and arranging data on national technology systems, and c) a flow analysis for documenting the flow of technology through the system. The Analytical Framework can be used to assess different types of agricultural technology systems - national, regional, and commodity. The Framework lends itself to comparative analysis across national systems and/or agricultural research and extension projects. The four subsystems of the Framework include: policy, technology development, technology transfer, and technology utilization.

Flow Analysis

An analysis of the data generated by the indicators is a principal dimension of the Analytical Framework. The analysis involves an initial mapping of the formal structure of the agricultural technology system to identify facilitating linkages. A flow chart is then developed that documents the reality of the functional linkages that integrate the systems and identifies possible constraints in technology systems. The flow analysis graphically illustrates how selected technologies enter or are created by the national system and how this technology flows through the system, from researchers to farmers. The flow analysis includes the time lags, to final utilization or rejection of the technology by the farmers. Three types of technology can be tracked in the flow analysis: a) genetic technology, such as new varieties and hybrids,
b) agricultural chemicals, such as new pesticides, and c) new cultural and management practices, such as dates of planting and fertilization rates.

The flow analysis illustrates the actual operation of a country's agricultural technology system, rather than the formal organizational structure represented by the government. The analysis of technology through the system can also provide a means for simulating alternative arrangements in finding workable solutions to the identified problems and constraints. Policy makers can evaluate the alternatives and can use the flow analysis to create a comprehensive implementation plan.

**Procedural Steps/Operational Phases**

Five major procedures are involved in the analysis of agricultural technology systems using the Analytical Framework:

1. The identification of all public, private, and other non-governmental institutions and organizations involved in the technology system.

2. The application of the key indicators to recognize strengths and weaknesses between and within each subsystem.

3. The tracking of specific types of technology through individual commodity systems (i.e., micro-system analysis).

4. The examination of the three major channels for tracking specific types of technology (i.e., genetic, chemical, and cultural practices) within the overall macro-system.
5. The identification and summary of the primary flow constraints operating on the macro-system.

The analysis of agricultural technology systems consists of four operational phases. Phase I involves a brief farmer survey or sondeo in a target region to ascertain farmer characteristics, resource limitations, and major farming problems from the producer's point of view. The sondeo contrasts information acquired from governmental sources and provides early identification of the problem areas in technology generation and delivery from the farmers' perspective. The sondeo is a necessary check on the viewpoints from within governmental departments. Phase II includes introductory meetings with top level representatives of the Ministry of Agriculture, including research and extension. Information about the user subsystem is restricted to an analysis of various farmer organizations within the national technology system and from the sondeo. Phase III involves the collection of data from published documents and interviews with administrators, managers, and other personnel in each of the subsystems. Data collection is aimed at analyzing the macro and subsystem components of the technology system and their linkages. The preparation of the written report is completed in Phase IV.

Criticisms of the Analytical Framework

The Analytical Framework can be considered a one-way linear model of technology transfer (Roling, 1990). One-way models of technology transfer assume that the researcher creates a new technology, the new technology is transferred to
extension for delivery to the users, and is either accepted or rejected by the users. One-way models of technology transfer usually succeed in delivering technology to the more progressive farmers; small-scale and marginal producers are often neglected. The Analytical Framework is based on the premise that agricultural technology is science-based and that technological innovations are not driven by policies, markets, or farmers. According to Roling (1990) the Analytical Framework does not adequately reflect the flow of information and influence from technology users to other parts of the system. An argument can be made that farmers may generate information and "new" technology. One-way models of technology transfer do not allow for the exchange of information among subsystems and the roles of each subsystem are stereotypic and not interchangeable. Roling (1990) contends that several effective technology systems (e.g., U.S. Land-grant model, the Dutch farm development system, and the Taiwanese system) clearly demonstrate that user control and input in some form is an essential ingredient in successful technology transfer.

The Technology Transfer Process

Technology transfer takes place when there is a source, a transfer mechanism, and the utilization of knowledge (Essouglow, 1975). The major goal of technology transfer should be the transfer of science or the capacity to generate indigenous technology appropriate to the needs and circumstances of a developing society (Compton, 1984). Oyer (1984) contends that "technology is defined as the knowledge
and means used to produce the material necessities of a society". To aid the improvement of technology, especially in the less developed countries, international centers have been established in regions which have similar climatic conditions to these countries. In addition, an international network has been formed linking research centers and universities in the developed countries with research centers and universities in the less developed countries. Hopefully, new technology can be successfully transferred between the networks. Technology is successfully transferred when farmers adapt the technology. The farmer might not adapt the new technology if proper support is not in place. This support includes a proper marketing system, readily available inputs, favourable pricing policies, and proper infrastructure. Oyer, also argues that one of the key ingredients to effective transfer is to have locally trained personnel. Studies have shown that countries that have locally trained persons benefited more from research than countries that do not have locally trained personnel. Other factors that aid effective transfer include an extension system that the farmer believes in and trusts and farmers that are capable of assessing the merits of the new technology and how it can help them. Transfer of technology is not limited to transfer from extension agents to farmers, but also includes transfer from an innovative farmer to other farmers facing similar conditions.

Kesseba (1990) identified some constraints to the transfer of technology. Small farms tend to be significantly different from large farms. Small farms tend to be marginal and engage in subsistence farming, but may generate surplus for marketing. Small farms use traditional methods which have been adapted to their
conditions and needs over time. Because of their limited resources, the farmers tend to be reluctant to embrace new methods and technology. Most agricultural research focuses on improved yields by using high-cost inputs (i.e., fertilizers, irrigation, pesticides), which the large farmers with more resources can undertake. Most small farmers have very limited resources and are unwilling or unable to make use of the research especially if the research is not fully tested and the farmer has to bear some risk of failure. The end result is that the needs of small farmers are basically ignored. For research to benefit limited-resource farmers, researchers must take into account factors other than increased production, they must consider the socio-economic status of the farmers. In addition, researchers must decide if increased yields are beneficial or if diversification into other crops is more appropriate or if better use of limited resources is the most effective plan for improving the conditions of the small farmer.

For effective transfer of technology, Compton (1984) identifies these two aspects of the farmer-extension interface: a) the interpersonal skills of the extension agents, they must be able to convince the farmers that they are on their side and foster an atmosphere where the farmers are motivated to do things to improve and b) the extension agents should use a combination of communication and teaching procedures to cater to as many learning styles as possible. For example, different farmers could be trained in different methods and the farmers then transfer knowledge among themselves. Regardless of the teaching methods used open
dialogue and critical thinking must be an integral part of any technology transfer process.

In addition to mass media, Colle (1984) suggests using audio tapes as a cost-effective way of transmitting information to farmers. Most agricultural systems do not have sufficient extension agents; using audio tapes reduces the number of extension agents that are needed by using less technical persons. It is important that the audio tapes do more than merely pass on knowledge. The tapes need to make the farmers aware of the need to make changes. It is only if the farmers are aware of the need to change will they be able and willing to embrace new technology.

The Concept of Linkage

Linkage is a term used to indicate that two systems are connected by messages so as to form a greater system. If the barriers between the two systems are permeable enough so that messages can flow out of each to the other and so that response messages can flow into each from the other (i.e., feedback) then a link or a state of linkage has been created between the two systems. A single exchange of messages will not suffice as an adequate definition of linkage. The term "linkage" is used to suggest a regularized pattern of interaction between two systems which in reality forms a bond between them (Havelock, 1971).

Linkage as an explanatory factor signifies the degree of interpersonal or intergroup connection, and the extent to which mutual communicative relations exist
among two or more systems. The more linkages there are and the stronger these linkages are, the more effective will be the day-to-day contact and exchange of information, hence the greater will be the mutual utilization of knowledge. Most importantly, the greater the number of linkages throughout the system of knowledge, production, and dissemination, the more frequent and the more effective will be the utilization of knowledge by all (Havelock, 1971).

Essouglow (1975) defined the linker as the individual or groups who link the source of knowledge to the user. Rogers and Kincaid (1981) define linkages as a communication relationship between two units in a system. Formal linkages follow officially specified patterns, whereas informal linkages do not. Formal linkages include committees, commissions, task forces, liaison officers, subject matter specialists, joint plans, and policy mandates (Kaimowitz, Snyder & Engel, 1990). Informal linkages consist of exchange of resources and information without official sanction or through personal contacts. For example, marketing agents or farmers who encounter a technical problem can go directly to the scientist or researcher for discussion. Informal linkages do not require official sanction (Pray & Echerria, 1990).

The Linkage between Research and Extension

There is general consensus in the literature (Rivera, 1988; Cummings, 1981; Fernadez, 1981) that agricultural technology systems in many countries fail to
function effectively because of the dependence on linkages which intended to integrate the system, are either weak or non-existent. The Cooperative Extension Service (CES) is the formal agricultural extension system in the United States of America. The origins of the CES date back to the late nineteenth century when Land-grant colleges were established and the early twentieth century when the Smith-Lever Act was passed. This act allowed for the "diffusion of information generated at the Land-grant colleges and federal research stations among the people of the United States". The CES has since served as a prototype for agricultural extension systems around the world. The success of the CES can be attributed in part to the linkage between research and the intended audience (Butler, Schriefer & Diamond, 1986).

Many countries have tried to replicate the U.S. extension model, but have failed. The main cause for this failure lies in the weak or non-existent link between research and its intended audience. The underlying reason for the weak link is a lack of communication between research and extension personnel. The lack of communication can arise because the two systems are usually administrated by different governmental departments and researchers and extension personnel do not appreciate each other's functions (Butler, Schriefer & Diamond, 1986).

Strong linkages between research and extension will allow the needs of the intended audience to be heard and new technology developed and disseminated to that audience at a level that they can assimilate. However, strong linkages do not represent the only condition for rural development; adequate infrastructure, credit,
and marketing must be in place to have successful rural development programs (Bulter et. al., 1986).

Kaimowitz (1991) has traced the development of the linkages between research and extension. As recent as the post World War II era, extension agents had virtually no connection with research. Some extension duties involved collecting statistics, organizing community activities, and managing credit for farmers. The methods and practices the agents passed on were learnt from formal education, personal experience, or foreign extension agents, not from current, in-country research. Researchers on the other hand, concentrated on plant breeding, new crops, and soil research; research that benefits large, export-based farmers rather than small, indigenous farmers.

In the latter part of the 1950s and early 1960s, policy makers recognized the need for linkage between research and extension. A top-down model was developed. In this model, researchers expanded their experiments to on-farm trials with the extension agents providing logistic support. The agricultural system dispensed with the notion that technology could be imported instead of being developed or adapted locally, but the model did not incorporate any feedback from the farmers to the researchers.

In an effort to determine the degree of linkage between research and extension, Swanson and Peterson, (1989) surveyed Directors of Extension from six areas of the world. The directors were asked to rank the linkage between research and extension from very weak, weak, ad hoc, moderately strong, to very strong. The
highest ranking was moderately strong with ad hoc the second highest ranking. Regional differences were noticed; the more industrialized areas (i.e., Europe and North America) had higher rankings than their counterparts in the less developed areas. The amount of research materials that extension agencies received over a 12-month period appeared to be adequate, but it was not known how much of this material was relevant or used by small farmers.

Coulter (1988) determined that there must be close interaction between extension and research systems or else the farmers - the intended users - might never make use of new research/technology because the technology does not address their needs or it is not suitable for their conditions. The interaction between extension and research can help to eliminate the problem of non-usage. If there are linkages at the institutional level, then the two systems will mutually support each other and if there is linkage at the personal level then extension and research personnel will be able to understand each other's problems so that the researchers can develop the appropriate technology and the extension workers can communicate the technology to the farmers.

Kesseba (1990) noted that most research and extension systems in developing countries are geared towards large farms and thus the specific conditions - marginal and subsistence farming, extensive use of family labour, especially of women and little external outputs - facing the small farm sector tend to be overlooked. To serve the small farm sector the research and extension systems must integrate the needs and constraints of the small farmers into the system. Kesseba also points out that
an important aspect of the generation and transfer of technology is the link between research and extension. These two systems may develop independently and remain separate in most countries, although some developing countries have started to generate some linkage between research and extension. Compton (1984), Coulter (1988), and Butler et al. (1986) have also found that the formal, institutional link is usually weak because the two systems are in different ministries or even if they are in the same ministry they are effectively separated. It is uncertain if the lack of a formal link prevents the formation of informal links or if the lack of informal links is due to a "cultural gap"; that is, extension workers might see researchers in an "ivory tower" out of touch with reality while the researchers might perceive extension workers as intellectually inferior. Setting up formal linkages is fairly easy, getting the two system to cooperate on a more informal basis is somewhat more difficult.

Kaimowitz (1991) has identified four ways to improve the linkages between research and extension. First is housing research and extension under the same administration. Several Latin American countries have tried this approach but they have run into problems. In fact some countries have opted to separate the extension and research systems again. Problems in integrating both systems include the combined system becomes too large and bureaucratic, different management styles creates conflict, and the two systems compete. A study done in Columbia identified five criteria that must be met to ensure, but not guarantee that extension and research can survive under the same administration: a) extension and research must both have the same goals, b) administrators must be committed to making the two
systems work together, c) the combined research-extension system must not be too large, d) financial, human, and managerial resources must be adequate, and e) the extension service must not be highly politicized. The second way to improve the linkage is to use liaison units (i.e., employ personnel whose primary function is to bridge the gap between the researcher and the Extension agents). The liaison units include subject matter specialists, agricultural communication units, and research and extension liaison officers. This method is not without problems: a) if the roles and responsibilities of the liaison unit are not clearly defined then the researchers and the Extension agents might not make use of their services and b) the liaison unit might develop its own jargon and methodology which neither the researchers nor the Extension agents can understand, hence limited communication.

A third way to improve linkages is through research-extension meetings where matters of mutual interest are discussed. The major problems associated with this method are researchers, Extension agents and administrators all have different agendas and researchers usually have scant regard for the Extension agents' inputs. Another method of improving the research-extension link according to Kaimowitz (1991) is to foster activities that both groups can participate in. Joint activities include, but are not limited to, field trials and diagnostic activities. Researchers and extension agents working together can create informal links and foster a strong team spirit between the two groups.

Tchouamo (1986), in a study of the Extension system in Cameroon, found that extension duties were performed by several different agencies and there was some
overlap which led to wasted financial and human resources. This overlap also resulted in confusion, frustration, and conflict among the different extension workers. In 1984, research and extension were placed under the same ministry by decree, but no formal linkage was established between the two systems. Not only is there no formal linkage, but the two groups are actually hostile to one another. The hostility is mainly due to preferential treatment and status of one group over the other.

An experience in India was more encouraging. Mehta (1988) reports that when a Training and Visit System was implemented, strong linkages between research and extension were established by frequent meetings, workshops, and seminars.

Carey (1987), Kesseba (1990), and Mundy, Syam, Rangkuti and Budiman (1992) agreed that the lack of or weak link between extension and research has meant that there has been limited understanding of the diversity and complexity of the small farm sector, which severely hampers the transfer of technology. Small-farmer input has not been recognized as an important factor in the transfer process. Strengthening the small farmer linkage would make policy makers more aware of what is happening in that sector and thus make recommendations that are relevant.

Kesseba (1990) outlines three ways of improving the linkage between research and extension: a) functional improvements through on-farm research initiatives, b) structural improvements by placing research and extension under the same institution or by forming committees with members from both extension and research, and c) functional improvements where research and extension are
considered as a continuum in the technology system, distinguished from program or structural improvement. There must be improvement in policy and decision making, research generation, research transfer, and research utilization. Kesseba goes on to identify four objectives that must be satisfied before effective linkage can be achieved: common interests and goals among policy makers, extension and research personnel and farmers, mutual respect, mutual inter-dependence, and common funding. Proper linkages can provide a means by which everybody's objectives can be reconciled. Two ways in which research and extension linkage can be strengthened are extension personnel and farmers working together on on-farm trials and using researchers as subject matter specialists to support the extension program. To guarantee that small farmers' needs and objectives are addressed, it is imperative that the voice of these farmers is heard when policies are being made and priorities are being set for the technology system. Farmer input can be accomplished by field days at research stations and the establishment of cooperatives and other farmer organizations. Kesseba (1990) reached the conclusion that research and research-extension committees should pass through two steps: a) findings, tested in applied trials under different conditions and b) evaluation of the effectiveness of the applied trials through a series of adaptive and on-farm trials by the SMS. The research-extension-farmer linkage must support the transfer of technology from researchers to the farmers and feedback from the farmers to the researchers.

The Madhya Pradesh experience (Mehta, 1988) illustrates Kesseba (1990) ideas. In Madhya Pradesh, new technology is passed on to the farmers by the
extension workers in three stages. First, data from adaptive research and the farms are analyzed statistically to determine which varieties are suitable for which areas and general recommendations are formulated at zonal workshops. Secondly, specific recommendations from the general ones are then made at the monthly workshops and passed on at the fortnightly training sessions of extension workers. Thirdly, the new practices are then passed on to contact farmers and innovative cultivators. The experience of these farmers are then used to evaluate the new practices. Changes based on the experience of these farmers are discussed at fortnightly training sessions, monthly workshops, and extension-research meetings before the practices are given to farmers on a large-scale basis.

One important aspect of the research-extension link is the flow of information between the two systems. Carey (1986) looked at the role of the information staff and found that the information staff was expected to mechanically pass the information to the extension staff who must make the research meaningful for the farmers. The true role of the information system is to interpret and process the knowledge from research in a form that the extension agents can use. Carey identified three important factors to consider in the transfer of technology to the farmers: a) the staff should have sufficient knowledge to deal with farmers’ questions, b) farmers have some ideas as to what is best for them, and c) the researchers provide practical and useful solutions and feedback from the farmers. The extension agent will have sufficient knowledge if the information staff can interpret and simplify the information from the researchers. It is the extension agents’ duty to
communicate the farmers' problems to the researchers and to provide feedback from the farmers. Thus everybody has an important role to play; no one can work effectively in isolation.

In a study on the extension-research system in Indonesia, Mundy, Syam, Rangkuti & Budiman (1992) found that the extension-research link was very weak and extension workers had very little contact with researchers. The results from the study showed that the subject matter specialists' main link with research is through publications. Other links, such as meetings with scientists and attending seminars are much weaker. The main problems identified were mobility, obtaining information from research, availability of appropriate technology, extension-research feedback, and lack of technical skills. The sources of information for the specialists were field extension workers, other extension specialists, farmers, and their superiors; all people that the specialists meet frequently. The specialists stated that they would like to have more access to research publications. Specialists who had more contact with field agents and farmers relied on field agents and farmers for their information, while the specialists who relied more on research, had more contact with researchers than with field personnel. Thus the specialists gleaned most of their information from the sources that they have the most contact with. Mundy (1992) concluded that a specialist will use a source if it close, well-known, and provides relevant and timely information.

Jain (1985) examined the relationships between research and extension in India. He identified several problems with the creation of an effective research-
extension system: a) the lack of formal linkages between researchers and extension agents, b) the gap between the development of relevant technology and the adoption of the technology by farmers, c) little opportunity for receiving feedback among the parties involved in the technology system, and d) the inability of extension to identify and address production problems throughout the country. Through the implementation of the National Agricultural Research Project (NARP), the country is attempting to move from a centralized research program to location-specific research centres in the 16 Indian states which represent 116 agro-climatic regions. The result of the decentralization efforts has been the establishment of multi-disciplinary research stations to meet the needs of the different climatic regions in the country and the development of need-based technology for each state. The NARP was created based upon the following four assumptions: a) the state agricultural universities are responsible for conducting location-specific research at the regional research station, b) the research should be based on local needs and be multi-disciplinary, c) resources for the research program should be integrated under an associate director of research, and d) operational linkages should be identified and maintained among the university research staff, extension officials, and farmers. The author listed several methods for maintaining linkages between the research and extension systems. Seasonal zonal workshops are conducted two times per year. During the workshops, researchers, extension agents, and farmers identify the immediate research problems in the area, they review the current research program, and recommend methods for the field testing and transferring of technology. Field
tests are conducted in two or three villages to provide an opportunity for researchers and extension agents to observe any problems from the farmers' perspective. An agronomist and an agricultural economist are assigned to each regional research center to help with the field testing. Agronomists focus on the relevancy of the technology, while the economists concentrate on production constraints and the economic feasibility of the technology. Subject matter specialists are trained monthly by university researchers as a part of the Training and Visit system to help connect research to extension. Specific technology transfer activities include short-term vocational training for agricultural workers and special assistance for marginal farmers and landless labourers in the areas of low-cost technology and self-improvement opportunities. In spite of the efforts of the NARP, research and extension linkages are still weak for three main reasons: a) researchers and extension agents are reluctant to change, b) artificial or forced linkages exist among the researchers, extension agents, and farmers with little appreciation of each other, and c) decentralization to regional research centres is slow. The author provides several suggestions for improving the communication between research and extension. On-farm testing of technology by researchers with follow-up, wide scale demonstrations by extension agents would help to identify more clearly the roles of each group. An extension counterpart needs to be identified for the regional research director. Research and extension should be seen as a functional unit at the regional level. All research activities conducted by the university should complement, not compete with extension activities and efforts.
In effective transfer of technology is frustrated by poor extension-research links. Kaimowitz (1991) notes that some institutions have experimented with doing away with extension and letting the research institutions be responsible for the transfer of technology. There are two ways to rationalize the elimination of the extension link: a) if the researchers are really in touch with the farmers and develop the right technology then the process of transfer becomes trivial. In reality, a small fraction of new technology is "self transferable" and b) set up farmers into groups and then transfer technology to these groups. These techniques might work fairly well for a small number of large farmers, but it almost certain to be a disaster for a large number of small farmers. For example, if there are only 10 farmers it is easy for them to meet informally and exchange knowledge, on the other hand, it would be very difficult for 200 farmers to meet and exchange knowledge without a formal and organized system.

Summary

Chapter II presents a description of the Analytical Framework, a dissuasion of the transfer of technology, and discussion of the linkage process with an overview of what is known about the research-extension linkage. The Analytical Framework aided the researcher in the construction of the study and served to organize the data collection process and the field procedures necessary to analyze agricultural technology systems. The Analytical Framework considers the major elements of an
agricultural technology system and examines the linkages among the different subsystems. The analysis provides a holistic inductive approach for exploring the strengths and weaknesses of the agricultural technology system. This study focused on two-subsystems of the Analytical Framework: technology development and technology transfer.

The term linkage is used to suggest a regularized pattern of interaction among the research, extension and user systems, which in reality forms a bond between them. A single exclusive message will not suffice as an adequate definition of the linkage process. Communication must flow from the researcher to the farmer via the extension system and from the farmer to the researcher through the same route.

The review of literature supports the fact that the link between research, extension, and farmers is placed on the list of major concerns for extension success. The World Bank (1985) notes that bridging the gap between research and extension has probably been the most serious institutional problem in developing an effective research and extension system.

Several researchers (Compton, 1984; Venkatesen, 1989; Ruttan, 1987; Bennel, 1990; Elz, 1984; Benor & Baxter, 1984; Palmer, Voliv & Kocher, 1983; Bennell, 1990; Sands 1988) contend that the gap between extension and research is due to separate work plans, research and extension working in isolation, instead of working as a team, separate budgets that do not provide for joint field activities and training, separate institutional housing, and attitudinal problems caused by the socio-economic gap between researchers and extension personnel, extension personnel are underpaid,
less educated, have less prestigious jobs than researchers, and extension personnel generally feel that researchers are elitist and they tend to ignore serious farm problems.

A meaningful triangular interaction among research, extension and farmers is needed to give a more dynamic focus and encourage greater collaboration between researchers and limited resource farmers. The literature confirms that a strong link between research and extension is needed because most of the educational activities conducted by extension originate from the research system (Claar & Bentz, 1984). The coordination among these systems is therefore essential to the technology transfer process. The lack of a viable research and extension linkage would be a serious impediment to the technology transfer process.

"Linkage along the research-extension-farmer continuum is critical. Without effective interaction along this continuum, extension could be thought of as a truck speeding without lights (no policy direction), with no cargo (no technology), and without clear destination (no targeted clientele)" (Rivera & Shram, 1987). The burden of this interaction rests as much with policy makers and researchers as with extension professionals. The main purpose of this study was to describe the research and extension systems in Jamaica and to analyze the linkages between the two systems.
CHAPTER III
METHODOLOGY

Introduction

The purpose of this chapter is to describe the research procedures that were followed in conducting the study. The procedures include the research design, data sources, instrumentation, data collection, and data analysis.

Research Design

The design for this study is a descriptive analysis. The study is designed to describe and analyze the Jamaican agricultural research and extension systems, specifically the linkages between the two systems. The Analytical Framework, illustrated in Appendix A (Swanson & Peterson, 1989) was used to develop the conceptual foundation for the study. This study focused on the technology development and technology transfer subsystems of the Framework.

The Analytical Framework is based on a qualitative systems macro-model and was developed to guide the description and analysis of agricultural technology
systems. The systems approach views national technology systems as a functioning whole composed of subsystems and their elements and linkages. The Framework is holistic; instead of emphasizing one or two components of a technology system, the entire system is considered. Recognizing the linkages which connect the components of a technology system is an essential aspect of the Framework.

The Framework depicts the realities of a country's agricultural technology system and features the strengths and weaknesses of the system. The analysis offered by the Framework identifies likely constraints that may limit the effectiveness of national technology systems. The analysis suggests where interventions should be made on behalf of improvement. A case study approach is used to provide descriptive information, indicator data, and an analysis of facilitating and operational linkages among the parts of the technology system.

The Analytical Framework can be used to assess different types of agricultural technology systems - national, regional, and commodity. The Framework lends itself to comparative analysis across national systems and/or agricultural research and extension projects.

**Functional Components**

The macro-model is made up of four subsystems, plus the linkages that join them together. The four major functional components of the Analytical Framework are:
1. **Policy** - those external factors that directly impact the agricultural technology system, including the utilization of technology by farmers. Policy indicators focus on the government's investment in agriculture, price policies for agricultural products, available credit for farmers, and farmer participation in policy decisions.

2. **Technology Development** - the part of the agricultural research system that is devoted to applied and adoptive research. Technology development indicators focus on the access of external sources of technology, human resources for technology development, research program budgets, and resource allocations to agricultural commodities.

3. **Technology Transfer** - the transfer activities related to knowledge and inputs. Technology transfer indicators concentrate on the access to technology from research, human resources for transfer activities, transfer personnel supervision and administration, the time and budget allocated for technology transfer activities and methods of technology dissemination.

4. **Technology Utilization** - the use of agricultural technology by farmers, with an emphasis on small holders. Technology utilization indicators focus on the adoption of selected technologies, farmers access to the technology, and the availability of the technology to the farmer.
Indicators and Measures

The macro-model has a set of indicators and measures to help analyze national technology systems. Originally 47 indicators and 71 measures were developed. Through a series of four in-depth case studies conducted in Ecuador, Mexico, Malawi, and Taiwan and an extensive review of literature, the Framework was reduced to 18 indicators and 36 related measures. The comparative analysis of the indicators and measures across the case studies resulted in the selection of the most effective measures. The empirical test for the indicators and measures centred on two basic questions: a) Which indicators and measures were most effective and efficient in describing and measuring an agricultural technology system? and b) Which indicators and measures were operational in the field? Multiple literature references indicated consensus on the importance of the indicators and measures to technology systems.

The indicators and measures are connected to the primary functions of a technology system and gather both quantitative and qualitative data about the level of resources or inputs, types of organizations and activities, and the outputs that are associated with the four components of a technology system. The indicators and measures are a means of gathering data; no individual indicator or measure can be used in isolation for diagnostic purposes. The composite analysis of all the indicators reveals a holistic overview of a technology system. The indicators serve to organize data collection, provide data for comparison between countries, and furnish the basis
for diagnosing system constraints. Analyzing the indicators provides objective data in terms of resources, activities, and outputs of each subsystem.

Rationale for Selecting the Framework

As a systems model, the Analytical Framework considers the major elements of an agricultural technology system and examines the linkages among the different sub-systems. The analysis provides a holistic, inductive approach for exploring the strengths and weaknesses of the system components. The Framework allows the researcher to view national technology systems from several perspectives. The researcher is not limited to one, isolated aspect of the system, but rather studies the system as a functional whole. The interactive analysis creates a detailed description of the technology system and clearly identifies constraints within and among the subsystems.

The Framework is based on an extensive review of literature. Numerous research studies and articles were reviewed to provide a sound theoretical foundation for the Framework. A comprehensive approach was used to select and examine the initial 47 indicators, followed by a consensus strategy to choose the final 18 indicators and 36 measures. The Framework has been validated by several case studies conducted in the major areas of the developing world: Africa, Latin America, and Asia. Country-specific agricultural technology systems and single agricultural
commodities have been analyzed by the Framework. The Framework serves as a comparative analysis between and within technology systems.

Information on a specific agricultural technology system is gathered from multiple sources, including face-to-face interviews and examination of government documents. The analysis depends upon a variety of data sources and allows the researcher to compare and contrast information obtained from different areas. The Framework does not rely upon a single source, but uses many types of data collection methods and techniques.

The Analytical Framework can serve as the foundation for additional, in-depth studies of each subsystem. As a diagnostic tool, the Framework highlights specific aspects of the technology system that need attention. Further studies can be designed that specifically focus on problems within and among the subsystems.

Figure 1 shows the conceptual foundation for the study based on the Framework of the linkages between the technology development and technology transfer subsystems. Agricultural research and extension are mutually dependent. Extension needs research findings to teach farmers, as well as the support from research in developing new technology to solve farmers problem. Few studies have attempted to investigate the adequacy of the linkage between Jamaican public agricultural research and extension systems which primarily serve over 80% of Jamaican farmers.
Data Sources

Data were obtained from two main sources: government documents and interviews with professionals from the Ministry of Agriculture. The government documents from the Ministry of Agriculture's communication and planning units, the personnel office, research stations, and extension offices included research and extension publications, annual reports, research reports, and budget documents. Other government publications provided census data and Central Bank information.

Twenty two professional staff were interviewed. They included researchers, research and Extension administrators and Extension agents. These professionals
were purposely selected to represent the public agricultural Extension and research systems in Jamaica.

**Instrumentation**

Two sets of instruments were developed by the researcher to collect the data. The first instrument was an interview schedule consisting of two parts. Part one addressed research personnel and part two focused on extension personnel. Nine open-ended questions were in each part and nine additional questions were used to describe the professionals interviewed. The interview schedule addressed the linkages between research and extension, technology development, technology transfer, research and extension programs, and salaries and resource allocations for these programs. The actual questions contained in the instrument were based on the indicators developed by Swanson and Peterson (1989). The interview schedules were tested for content validity by research and extension personnel in the College of Agriculture at The Ohio State University and the Jamaican Ministry of Agriculture (see Appendix B). Copies of the two interview schedules are located in Appendix C.

The second instrument (see Appendix D) consisted of 10 sections, with each section pertaining to a particular indicator and its measures. *A Field Manual for Analyzing Technology Development and Transfer Systems* (Swanson & Peterson, 1989) was used to guide the construction of the second instrument. A series of tables were
created for gathering the data for each indicator. The first section measured the degree of interaction of Jamaican researchers with external researchers. The three categories examined by this measure were genetic technology and International Agricultural Research (IARC) training and consultation. For each commodity chosen, an access score from 0-3 was assigned to each of the three categories; a 3 represented the highest level of external access, 2 was considered moderate, 1 indicated low external access and 0 indicated no access to external technology. An total index score of 9 represented the highest level of external access for any commodity.

The second section of the instrument consisted of three measures. The first measure examined the trends in the research capacity of the Jamaican agricultural research system by tracing changes in the number and educational level of research personnel over the last 10 years. The second measure examined the assistance given to scientists in the form of technicians.

The third section measured the percentage of the research budget allocated to research program/operations, salaries, and capital investments.

The fourth section measured: a) the financial investment in agricultural research of different commodities as compared to their contribution to the agricultural gross domestic product (AGDP) and b) the human resources allocated to different commodities compared with the commodity's economic contribution to the AGDP.
The fifth section examined the nature and extent of interaction between research and extension personnel including workshops, demonstrations, joint on-farm research activities, and training sessions. Selected types of contact (e.g., visits to research stations, on-farms trials) were evaluated and assigned a contact score from 0-3 to determine the level of contact. A 0 indicated no contact took place, 1 was considered low contact, 2 was considered moderate contact and 3 represented the highest level of contact. For each category an overall score of 15 represented the highest level of interaction contact between extension and research personnel.

The sixth section measured: a) the ratio of extension agents to farm households to assess the Extension system's capacity to serve its clientele, b) the capacity of the extension service to provide technical support and adequate training for field staff and c) the educational level, position, and years of training of extension personnel during the past 10 years.

The seventh section measured the personnel management practices used in the Extension system and the criteria used to evaluate these practices.

The eighth section measured the amount of time Extension agents spend on educational activities as compared to non-educational duties.

The ninth section measured the allocation of financial resources between Extension salaries and programs over the last 10 years.

The tenth section measured: a) the percentage of farmers visited by field Extension agents per year, b) the type of group Extension activities and the average number of these activities conducted by the Extension service annually, c) an
estimate of the average number of result demonstrations conducted annually by extension agents, d) the percentage of farmers or farm households who have direct contact with Extension agents either by individual visits, field days, or through group meetings, e) the potential of the extension service to develop mass media outputs and teaching materials, and f) the percentage of households obtaining agricultural information from the radio and the amount of minutes devoted per week to broadcast agricultural information.

Data Collection

Data were collected from August 31 to September 20, 1992. The data were collected by the researcher with personal supervision from the research advisor. Twelve days were spent in the capital collecting and reviewing government documents and interviewing research and Extension administrators. Three days were spent at research stations interviewing researchers and Extension agents. The two research stations chosen for the study were: Grove Place and Bodles. These stations were selected because they represent different geographical locations on the island and most of the research activities supported by the government are conducted at these two stations. Also, three extension offices were visited in Kingston, Clarendon, and Manchester.

The interviews began with a formal introduction and explanation of the purpose of the study and a summary of how the responses will help to better
understand the functional aspects and drawbacks of the agricultural technology system in Jamaica.

Data Analysis

Descriptive statistics (i.e., ratios, frequencies, and percentages) were used to analyze the data.

The first objective of the study was to determine the access to external knowledge and technology of Jamaican agricultural researchers. To analyze this objective, an index score from 0-3 was assigned to each commodity based on the access to genetic technology and international agricultural research center training and consultation. The following scale was used to calculate the index score: 0 = no access; 1 = low access; 2 = medium access; and 3 = high access. The highest possible index score for any commodity was 9.

The second objective of the study was to assess human resources for agricultural research in Jamaica. Two procedures were used to analyze this objective: a) a frequency table of the educational levels was constructed and percentages calculated and b) the ratio of technicians to total research personnel was calculated to determine the amount of technical support provided to the research scientist.

The third objective was to assess Jamaican financial allocations to salaries for researchers and research programs. To analyze this objective the percentage of the
research budget allocated to researchers' salaries, research programs and capital/maintenance was computed for a 10-year period.

The fourth objective was to describe Jamaican resource allocation to export commodity research and domestic commodity research. To analyze this objective, the percentage of the research budget allocated to research investment in domestic and export commodities was computed.

The fifth objective was to determine access to and availability of internal technology from agricultural researchers in Jamaica to extension personnel. To analyze the type and frequency of contacts between research and extension, a contact rating was calculated using the following scale: 0 = no access; 1 = low access; 2 = medium access; and 3 = high access.

The sixth objective of the study was to assess personnel resources for agricultural technology transfer in Jamaica. To analyze this objective the following procedures were used: a) the ratio of the total number of extension agents to the total number of farm households was computed, b) the technical capacity of the Extension system was measured by the ratio of number of SMSs to the number of professional extension agents, and c) staff qualifications were tabulated by level of training.

The eighth objective was to determine the time allocated by Jamaican extension agents to the transfer of agricultural technology. To analyze this objective, the percentage of time spent on educational and non-educational activities was calculated.
The ninth objective was to assess the allocation of financial resources between Extension agents' salaries and programs. To analyze this objective, the percentage of the extension budget allocated to extension programs and extension agents' salaries was calculated.

The tenth objective was to examine technology dissemination in Jamaica. To analyze this objective, the following procedures were used:

1. The percentage of farms receiving farm visits was computed as a ratio of the number of farm visits by extension agents to the total number of farms.

2. The total number of group activities completed per field agent was multiplied by the total number of extension agents.

3. The ratio of farmers who attended field demonstrations to the total number of farmers in Jamaica was calculated.

4. The percentage of farmers with direct contact was computed as the sum of farmers contacted through individual visits, group contacts and demonstrations by Extension agents to the number of farmers in Jamaica.

5. Different categories of media sources used by extension were listed and ranked in order of frequency of use.

6. The percentage of farm households with radios was obtained from Jamaica Information Service documents and the number of minutes of agricultural broadcasting per day.
The data obtained from the interview schedules were summarized according to each research objective. Data analysis involved documentation of trends and similar responses among the research and Extension personnel.
CHAPTER IV

JAMAICA: COUNTRY DESCRIPTION

Introduction

The purpose of this chapter is to provide a general overview and a brief description of the geography, history, economy and the agricultural sector of Jamaica. Jamaica is a middle-income country with a per capita income of US$1,510 (World Bank, 1991). The country had an estimated population growth of .9% in 1991 and a total population of 2.4 million with 43% of the population living in urban areas (Economic and Social Survey of Jamaica, 1992). Jamaica is well-endowed with natural resources, of which bauxite is the most important. Jamaica has a well educated and skilled labour force in adequate supply. The country enjoys close proximity to North American markets and possesses a well-developed financial system. Kingston, the capital, has an estimated population of 500,000. The other principal urban areas are Spanish Town and Montego Bay with estimated populations of just under 100,000.

The principal economic activities are bauxite mining and processing, tourism, manufacturing, and agriculture. Together these sectors account for over 75% of the
country's Gross Domestic Product (GDP), 50% of the labour force and 75% of its foreign exchange earnings (Economic and Social Survey of Jamaica 1992).

The chapter is organized in the following order - geography, history, economy, and the agricultural sector (i.e., land tenure, farm size, credit institutions, technology development, and technology transfer).

Geographic Review

Jamaica is the third largest of the Caribbean Islands and the largest English speaking island (see Appendix E). Its total area is 4,411 square miles, 146 miles long, and with widths varying from 22 miles to 58 miles (Black, 1975). Jamaica lies 90 miles south of Cuba and 100 miles west of Haiti. Jamaica is a very mountainous country, with almost half of the island above 1,000 feet. The island topography is divided into three basic land forms: the coastal plains, the central plateau, and the eastern highlands. The Blue Mountains dominate the eastern portion of the island. The highest point, the Blue Mountain Peak, rises to an elevation of 7,402 feet. The mountains are steep, rugged, and characterized by V-shaped interlocking valleys of dense forests (Black, 1975; Floyd, 1979).

The soil types include: a) alluvial soil composed of clay and deep loam, b) bare rock and thin, easily erodible soils characterize the upland areas, c) residual clay in the valleys, permitting small-holder agriculture, and d) the terra rossa soils that contain a high concentration of aluminum hydroxide (bauxite) formed by the
weathering of limestone rocks. Bauxite is the primary mineral resource in Jamaica and is concentrated in the central and western portion of the island. The reserves are among the world's largest, over 300 million tons (Bent, 1965; Bent-Golding, 1965).

Jamaica has a tropical climate, but there are regional variations due to the mountain ranges and the highlands. On the southern plains, a daytime wind comes from the sea, and after sunset light offshore winds cool the island. From January to February the island is sometime subjected to masses of cold air from the North American continent, which causes the temperature to decrease drastically. The annual average temperature is 80°F, but the temperature varies throughout the island. Kingston has an average day time temperature of 87°F, with a night time low of 69°F in January and 75°F in July. The higher elevations of the interior are 10-20 degrees cooler. Humidity is relatively high ranging from 63% in February to 75% during October in Kingston and between 71-77% in Montego Bay (Floyd, 1979).

The annual average rainfall is 78 inches. However, the amount of rainfall varies significantly from region to region due to the mountainous interior that obstructs the rain-bearing northern tradewinds, forming a rain shadow in the southern areas. As a result, the northern side of the island receives approximately 100 inches annually, while the southern areas average about 30 inches. The period of highest rainfall is between September and November (Floyd, 1979).

Jamaica has 120 rivers with most flowing from the central mountain ranges to the coast. Those flowing on the north side tend to be shorter and much swifter
than those on the south side. The Rio Grande River, in the east, is the largest, followed by the Black River in the west. The Rio Grande is used for tours and transportation of agricultural products. Jamaica has several mineral springs, three of which are developed with facilities for bathing and accommodation (Black, 1965; Floyd, 1979).

**Historical Background**

The first Jamaicans were Arawak Indians, believed to have emigrated from the American mainland via Trinidad and Cuba. They lived by cultivating maize and cassava and fishing and hunting for birds and wild animals. They settled the entire island even though most of their villages were located primarily along the sea coast and rivers.

Columbus landed on the island in 1494, which marked the beginning of 150 years of Spanish rule. The island economy under Spanish rule was based on agriculture. The Spaniards introduced bananas, plantains, citrus fruits, pigs, goats and cattle to the island. Sugar was grown for local consumption and other crops produced included tobacco, cotton, and cocoa. With the increase in agricultural production, Jamaica quickly became a supply base of raw materials and agricultural products for the European market. In order to maintain the supply of clothing, oil, wine, and wheat, the Arawak Indians were forced to work for the Spanish colonists on large plantations. They were overworked, brutalized, and underfed, resulting in
a large faction of the native population dying from diseases and starvation. Many committed suicide and by 1655, the Arawak Indians were extinct. The Spaniards then imported negroes from Africa to work on the plantations (Black, 1975).

The island became a British colony in 1655 and remained one until 1962 when independence was granted. Under British rule the island's government reflected the British system and laid down the pattern of government that would last for almost 200 years. Throughout most of the British colonial period, Jamaica's growth and development was influenced by the plantation system of agriculture. The plantation system was the unit that produced export crops, particularly sugar, in large quantities, and formed the framework on which the economy and social structure of the island was based. To maintain the plantation system, the British brought many Africans to work as slaves, most of which came from the west coast of the continent. Under British rule, much of the arable land was turned into sugar plantations. However, by the late 19th century sugar production declined drastically due to competition from beet sugar. Bananas, coffee, and cocoa grew in importance to the island's economy (Black, 1975).

Life was not always easy for the early colonists as the Maroons (slaves left behind when their Spanish masters fled the island) engaged the British in constant fighting and provided safe havens for runaway slaves. In 1738, the Maroons and the British signed a peace treaty, whereby runaways slaves were to be returned to the plantations and the Maroons received self-government and the tracts of land on which to cultivate. Descendants of the Maroons still live today on these lands in the
hilly Cockpit Country in western Jamaica and at Moore Town in the hills of Portland in eastern Jamaica (Black, 1975).

When the slaves were totally freed in 1838 most of them deserted the plantations to cultivate small plots of land in the hills of which, today is still regarded as the "backbone" of Jamaican agriculture. The British then brought in the Chinese and later East Indians as indentured labourers to work on the plantations.

More than 90% of the Jamaican population is of African decent and the African heritage is still evident in the food, religious groups, music, dances, and proverbs. Although the official language is English, the majority of the population also speak Jamaican Creole called patois, which is a mixture of English and African dialects (Black, 1975).

In 1958, ten territories in the British West Indies formed the West Indian Federation. The Federation was beset by many conflicts mainly between Jamaica and Trinidad, as a result the Federation collapsed in September 1961 when Jamaica withdrew. Immediately after withdrawing from the Federation, a delegation led by the Premier of Jamaica flew to London to discuss the island's independence. On February 6, 1962, it was agreed that Jamaica would become an independent nation on August 6, 1962 and remain a part of the British Commonwealth of Nations.

Jamaica has a parliamentary democratic system of government where the Members of Parliament are elected by the populace and the Senators are nominated by the two main political parties. The Governor General is the official head of state, a purely ceremonial role. The real power lies in the Prime Minister who is usually
the leader of the party that holds a majority in the House of Parliament. The constitution requires that general elections are held at least once every five years. The last general election was held in February, 1989.

**Economy**

Jamaica is one of 35 middle-income countries of the world with a free market economy in which the private sector dominates and employs 47% of the labour force (Kurian, 1992; Economic and Social Survey of Jamaica, 1992). The main economic activities are tourism, agriculture, bauxite mining, and manufacturing. Tourism is the largest producer of foreign exchange, with over one million visitors per year. Estimated gross earnings for tourism in 1991 amounted to US$764 million, an increase of 3% over 1990 (Economic and Social Survey of Jamaica, 1992).

Total foreign exchange earnings from agricultural exports during 1991 increased by 10% over 1990 to US$177.6 million, exceeding the target set in the government's five-year plan. Traditional export crops which earned US$160 million showed an increase of 10%, while earnings from non-traditional crops grew by 14% to US$18 million. The most significant export crops, sugar and bananas, contributed 78% (US$139) of the total foreign exchange earnings in the agricultural sector (Economic and Social Survey of Jamaica, 1992).

The inflation rate for 1991 was 80% on a point-by-point basis or an average of 51%. The major factors influencing this record high inflation rate were a 60%
depreciation of the Jamaica dollar (against the US dollar) and large increases in the money supply. The rate of inflation is expected to decline in 1992. The unemployment rate in 1991 was 15.4% a marginal increase over the 1990 rate of 15.3%.

Jamaica is one of the world's major producers of bauxite and alumina. These two products accounts for 9% of the GDP. The total net foreign exchange earnings for 1991 were US$248 million, 11% below 1990 due to lower world prices for aluminum (Economic and Social Survey of Jamaica, 1992).

The manufacturing sector has grown from the processing of a few agricultural products into one of the most important economic sectors, contributing 20% to the GDP and employing over 11% of the labour force. The main industries include clothing, machinery, fertilizer, steel, and cement. The annual growth rate of the manufacturing sector during 1990-1991 was -4.5% and the value added was US$292.5 million (Economic and Social Survey of Jamaica, 1992).

**Agricultural Sector**

Although the agricultural sector has shown improvement in the last few years, the output/productivity is below what it was in the 1970s. Nevertheless, agriculture is still the major source of employment and an important source of income in Jamaica. In 1991, agriculture employed 27% of the labour force, an increase of 1.7% over 1990. The sector contributed 25% to the GDP and accounted for 9% of the
total export earnings. Recent increases in agricultural employment are due to expansion in the production of domestic and non-traditional export crops (Economic and Social Survey of Jamaica, 1992).

Small farmers account for 88% of all farms, and even under conditions of low productivity, they produce most of the country's food crops including vegetables, legumes, root crops, and fruits (FAO, 1979). Small farmers contribute over 25% of the value of agricultural exports which includes small percentages of coffee, cocoa, banana, pimento, ginger, and sugar (FAO, 1979). The productivity of small farmers is low because most of the farms are located on marginal hillside land and most of the work is done manually using simple tools. Modern technological inputs for increasing productivity are used sparingly and sometimes not at all. Efforts of successive government programs (e.g., land reform schemes, land lease, crop lien, and various subsidies) have been initiated to improve production on small farms, but many times these programs have been hampered by political differences (FAO, 1979).

One of the major policy initiatives implemented by the government in 1991 was the liberalization of the economy. Foreign exchange controls were lifted, all prices were freed, and all subsidies on imported food items were removed. Removal of price controls was to enable the economy to respond to market forces and to allow the farmers to sell their products at competitive prices. The liberalization of the foreign exchange market is expected to encourage the development of non-traditional
crops since exporters/farmers will be able to retain foreign exchange earnings from their exports.

Over 70% of all farmland in Jamaica is collectively owned by family members, which is passed down from one generation to the next (Fliegel, Swanson, Bentz, Becker & Sands, 1987). Other individuals have the rights to land being bought and others have access to leasehold land obtained under certain government programme. Land redistribution is a major government initiative designed to increase the productivity of small farms. Since 1972, Project Land Lease has provided land for over 45,000 farmers (FAO, 1979). Under the new distribution program, over 6,000 parcels of land of varying sizes will be distributed by the government on a freehold and land lease basis (Economic and Social Survey of Jamaica, 1992).

The principal sources of credit for the agricultural sector is provided by the Agricultural Credit Bank (ACB), the Peoples Cooperative Banks (PCB), other Approved Financial Institutions (AFI), and the Jamaica Agriculture Development Foundation (JADF). During 1991, the amount of credit allocated by the ACB via these banks totalled JA$127 million and the JADF disbursed a total of JA$133 million (Economic and Social Survey of Jamaica, 1992). Total agricultural credit was less than 2% of all commercial loans (Economic and Social Survey of Jamaica, 1992). Total loan allocation by the ACB to all sub-sectors declined by 67% compared with 1990 (Economic and Social Survey of Jamaica, 1992). The decline was due to a significant increase in interest rates on ACB loans. To offset the negative consequences that high interest rates could have on production, the ACB developed
a Production Incentive Program for small farmers. The objective of this program was to encourage small farmers to adapt new and improved technologies which could result in improved productivity and increased output. The program was financed from partial revenues obtained from the ACB.

The formal beginning of public technology transfer activities in Jamaica dates back to 1895 when the Jamaica Agricultural Society (JAS) was voluntarily formed by farmers. The farmers felt that an organization was needed that would cater to their specific needs. However, evidence suggests that provisions for technology transfer were in place as early as 1865 (Steer, 1968). The JAS provided and became responsible for technology transfer until 1951 when the responsibility was taken over by the Department of Science and Agriculture, now the Ministry of Agriculture. The functions of the JAS were transferred to the Ministry of Agriculture because agricultural extension activities, as a fundamental and integral part of agriculture, should be under the government's control and direction rather than under a voluntary organization operating on subvention provided by the government.

During the early years, the JAS was funded through membership fees, branch affiliation fees, proceeds from farmers' stores, and agricultural shows. In the early 1950s, the organization received funds from the government to support the society's mission to deliver educational programs. The goals of the JAS were to collect and disseminate useful information among farmers, encourage the use of improved cultural practices, rearing of better breeds of livestock, and to watch over the interests of the agricultural industry (Steer, 1968; Henry & Johnson, 1979).
The JAS is now one of the main collaborating organization of the Rural Agricultural Development Authority (RADA). Its main focus is to organize farmers and farm families to receive services from other collaborating and interested agencies and provide a link between RADA and rural development.

Technology development on a formal basis, began in Jamaica in 1908 when the first Director of Agriculture was appointed. A simple structure was adopted in the early years but as time progressed new functions were added which developed into a more elaborate research system. Initial research activities were primarily done with dairy cattle, but as the demand for technology development increased the system was broadened to include beef cattle, sheep, pigs, poultry, mangoes, cocoa, pineapples, corn pulses, Irish Potatoes, pasture grass, bananas and vegetables.
CHAPTER V

ANALYSIS OF THE JAMAICAN PUBLIC RESEARCH SYSTEM

Introduction

The purpose of this chapter is to describe and analyze the Jamaican public agricultural research system. The chapter is organized as follows: a) policy statement and organizational structure, b) current focus of the public research system, c) discussion and summary of data based on the indicators used to measure the performance of the research system, including comparative data based on similar studies conducted by Peterson et al. (1989) and d) a summary of the responses to the open-ended questions that addressed the research system. Nine research professionals were interviewed as a source of primary data to supplement the data gathered by the indicators. The research professionals interviewed ranged from the top executive in the Jamaican public research system to research assistants at the field level. These professionals represented all levels of the public research system in Jamaica. A list of the nine individuals interviewed can be found in Appendix F.
Policy Statement and Organizational Structure

According to the policy statement of the Ministry of Agriculture, the public agricultural research system is to be given the highest priority in the overall strategy for the economic development of the country. The activities of the system are to be regarded as pre-requisites to the achievement of sustained production and maintenance of productivity through the generation and/or testing of improved technology and methodologies. The aims of the Research and Development (R&D) Division are to establish a sound research base, provide solutions to current problems affecting crop and livestock production, and transmit research findings to relevant groups and organizations without delay.

Figure 2 represents the organizational structure of the public research system in Jamaica. The system is headed by a National Director who reports to the Permanent Secretary. The Permanent Secretary reports to the Minister of Agriculture who is a political appointee, either an elected Member of Parliament or a government senator. The three main research stations are headed by station directors who report directly to the national director. The organizational structure within each research station is the same. Each station director supervises a deputy director, the administrator, and any research substations that are attached to the main station. The deputy director oversees the research aspects of the station, with the department heads reporting to the deputy director. The department heads supervise the research and field assistants.
Figure 2. Organizational Structure of the Public Research System in Jamaica.
The national director post is currently held by a researcher with a PhD degree, although the job is mainly administrative with very little research activities. The station directors are also expected to have either a PhD or a Master's degree, and like the national director their function is mainly administrative with little research activity. The deputy directors have either a Master's or a PhD degree; they spend most of their time engaged in research with very few administrative duties. The department heads conduct research, and usually have a Bachelor's degree. The field and research assistants have diplomas.

**Current Focus of the Public Research System**

In 1908, the first Director of Agriculture was appointed, to mark the formal beginning of public agricultural research in Jamaica. Initial research activities were done primarily with dairy cattle, but were expanded to include sheep, pigs and poultry. Experiments with corn, pulses, and Irish potatoes began in the early 1930s followed by pasture grasses, bananas, and cocoa in 1946. Currently, the R&D Division of the Ministry of Agriculture has set four major targets: a) reorganizing and strengthening the Ministry of Agriculture, b) establishing and upgrading agricultural centres, c) implementing a research program in priority areas identified by the government, and d) upgrading local research skills through training programs.

The current focus of the Division is the development of appropriate technology for the production of domestic food crops, non-traditional export crops,
and livestock. Research and development activities are being pursued in three main areas which include crop production, livestock production, and plant protection (Economic and Social Survey of Jamaica, 1992).

The major focus of current crop research is on yam cultivation, sweet potatoes, Scotch Bonnet peppers, and Solo papaya. The major emphasis of the plant protection unit is on the effective control of mildew diseases of musk melon, disease and pest control in escallion and callaloo (spinach), biological control methods for the Diamond Back moth, and the control of different species of fruit flies.

The current focus of livestock research includes animal nutrition, feeding trials, genetics, replacement value of molasses, and urea multi-nutrient block as animal feed. Emphasis is also placed on performance testing of Jamaican beef cattle breeds with the pooled Brahman (imported), response of African Star grass to harvest-interval, and different levels of fertilizer treatment (Economic and Social Survey of Jamaica, 1992).

Over the years, special statutory bodies were created, such as banana, coffee, cocoa, sugar, citrus and coconut boards, to conduct research and extension activities related to their specific commodity. Even though these commodity boards have been given a fair amount of autonomy by the government, their overall policy must reflect national priority goals. The Ministry of Agriculture is not responsible for the allocation of resources to the traditional export commodities; quasi-government boards handle each major export commodity. (University of Kentucky, 1979).
Other organizations whose activities either complement, support, or otherwise have an impact on the R&D Division of the Ministry of Agriculture include the Caribbean Agricultural Research Institute (CARDI), the International Institute of Tropical Agriculture (IITA), the Inter-American Institute for Co-operation on Agriculture (IICA), the Jamaica Agricultural Development Foundation (JADF), the Canadian International Development Agency (CIDA), and the Food and Agricultural Organization (FAO). Research activities conducted by the R&D Division, the commodity boards, and various organizations have lead to duplication and fragmentation of research efforts leading to a waste of human and financial resources. Over the years, studies have recommended the need for strengthening, restructuring and reorganizing of the Jamaican research system to reduce duplication, focusing on priority problems and providing a more efficient and effective linkage between research and extension (University of Kentucky, 1979; FAO, 1979).

Most of the public research activities of the R&D Division are conducted at three main research stations: Bodles, Grove Place, and Montpelier. Technology is developed at these three centres or brought to the centres for adaptive research purposes by regional agencies, such as CARDI. These stations were established at various sites throughout the country to find solutions to farmers' problems in their specific ecological situations.

Work at the Bodles research station, which is conducted under irrigated conditions, focuses on livestock research and improvement and on pasture and crop research. The livestock department has the responsibility for dairy cattle breeding,
progeny testing, heifer rearing, animal nutrition, and evaluation of agricultural and industrial by-products as animal feed. The livestock improvement unit is primarily responsible for the collection, processing, and storage of semen for local use and export. Crop research has the responsibility for variety trials, plant nutrient studies, and improvement of cultural practices.

Research activities at the Grove Place research station, which are conducted under non-irrigated conditions, include beef cattle breeding and husbandry, pasture research, and sheep husbandry. The beef cattle research unit has the responsibility for development of beef cattle production systems on pasture with and without supplementary feed during dry periods and performance testing of different cattle breeds. The pasture research unit's primary function is testing of tropical grasses and legumes, variety trials, seed production, evaluation of drought tolerant varieties, varietal resistance to insects, pests, and diseases, and fertilizer trials. Sheep research involves performance testing of different stocking rates, feeding trials, and cross breeding.

At the Montpelier research station, work is carried out under non-irrigated conditions. Research activities include cross breeding for milk production of dairy cattle and intercropping studies to optimize land use and develop suitable cultural practices for plantain, cassava, coffee, and cocoa.
The following section addresses the four indicators that measure the factors that affect the performance of the Jamaican public research system. These indicators are: access to external sources of knowledge and technology, human resources for public agricultural research, resource allocation to research programs and salaries, and resource allocation to selected commodities.

**Objective 1: Determine Access to External Sources of Knowledge and Technology by Jamaican Agricultural Researchers**

Table 1 shows the external access ratings for six agricultural commodities. These six commodities are the main research program areas in the Jamaican Ministry of Agriculture. As indicated in the table, the commodity with the highest external access rating is legumes, followed by root crops. Germplasm from the International Potato Center (CIP) and International Institute for Tropical Agriculture (IITA) has been used in both the legumes and root crops research programs. The lowest external access scores were recorded for dairy and papaya due to the lack of genetic material for papaya and the use of indigenous dairy breeds. According to Peterson, Sands and Swanson (1989), the ideal mean external access rating is three. As illustrated in the table, none of the commodities received the highest rating.

Researchers within the Ministry of Agriculture were asked to identify the type and extent of interaction they have with researchers outside of Jamaica. Their responses indicated that travel to international research meetings was extremely
Table 1

The Public Agricultural Research System Access to External Sources of Knowledge and Technology

<table>
<thead>
<tr>
<th>Access To:</th>
<th>Commodity A Legumes</th>
<th>Commodity B Root Crops</th>
<th>Commodity C Cereal Grains</th>
<th>Commodity D Papaya</th>
<th>Commodity E Beef</th>
<th>Commodity F Dairy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Genetic Technology</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>International Agricultural Research Center</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Regular IARC Consultations</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Total External Access Rating</td>
<td>6</td>
<td>5</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Average External Access Rating</td>
<td>2</td>
<td>1.6</td>
<td>1</td>
<td>.66</td>
<td>1</td>
<td>.66</td>
</tr>
</tbody>
</table>

Note: Access ratings were based on the following scale: 0 = No Access; 1 = Low Access; 2 = Medium Access; 3 = High Access.

Source: Personal interviews with the Deputy Director of the Research and Development Division in the Jamaican Ministry of Agriculture and the Principal Researcher for Livestock at Bodles Research Station.
limited due to budgetary constraints. The researchers stated that funding for travel to professional meetings must be obtained from sources outside of the Ministry of Agriculture. None of the researchers interviewed had travelled outside of the country to research conferences or training sessions in the past year. However, in-country conferences and activities with researchers from other countries are occasionally available. The researchers mentioned the importance of networking and creating a cadre of professional contacts that would allow easier access to external knowledge. Although direct contact with researchers and research activities outside of Jamaica was considered minimal, access to international research journals and bulletins was judged to be excellent by the researchers.

**Objective 2: Assess Personnel Resources for the Public Agricultural Research System in Jamaica**

Table 2 illustrates the number and percentage of scientific personnel with different levels of training within the Ministry of Agriculture during the past seven years, 1986-1992. In 1986, the Jamaican public research system had 54 research personnel; however, seven years later the number of personnel had decreased by 41% to 32. This decrease would seem to indicate a declining level of investment in human resources for agricultural research in the public research system and a reduction in research capacity. Nevertheless, the percentage of personnel at the different levels has remained fairly constant during the period. Approximately 80% of the scientific personnel have certificates and Bachelor degrees and the remaining 20% have Ph.D. or M.S. degrees.
Table 2

Number and Percentage of Scientific Personnel at Different Levels of Training (1986-1992)

<table>
<thead>
<tr>
<th>Year</th>
<th>Ph.D.</th>
<th>Masters</th>
<th>B.Sc.</th>
<th>Diploma or Certificate Holder</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>%</td>
<td>N</td>
<td>%</td>
<td>N</td>
</tr>
<tr>
<td>1986</td>
<td>4</td>
<td>7</td>
<td>7</td>
<td>13</td>
<td>29</td>
</tr>
<tr>
<td>1987</td>
<td>4</td>
<td>7</td>
<td>7</td>
<td>13</td>
<td>28</td>
</tr>
<tr>
<td>1988</td>
<td>5</td>
<td>9</td>
<td>8</td>
<td>14</td>
<td>26</td>
</tr>
<tr>
<td>1989</td>
<td>3</td>
<td>6</td>
<td>8</td>
<td>15</td>
<td>24</td>
</tr>
<tr>
<td>1990</td>
<td>2</td>
<td>4</td>
<td>8</td>
<td>18</td>
<td>21</td>
</tr>
<tr>
<td>1991</td>
<td>2</td>
<td>5</td>
<td>5</td>
<td>12</td>
<td>22</td>
</tr>
<tr>
<td>1992</td>
<td>2</td>
<td>6</td>
<td>4</td>
<td>12</td>
<td>19</td>
</tr>
</tbody>
</table>

Swanson and Peterson (1989) indicated that level of training is an important factor that affects the performance of a national research system. Thus, the proportion of the research staff with doctorate, master, and bachelor degrees is an important measure of the quality of research personnel. A comparable research study conducted in Mexico (Peterson et. al., 1989) proposed that a realistic goal of a national research system should be a 20:40:40 ratio. In other words, doctorates accounting for 20% of the research staff and masters and bachelors each accounting for 40%. Table 2 shows that Jamaican researchers with doctorate degrees accounted for 9% of the research staff, with master's degrees and bachelor's degrees accounting for 20% and 71%, respectively. This pattern shows that the Jamaican public agricultural research system has been operating far below the recommended percentage of research personnel by level of training and number of staff to maintain a quality productive research system.

Results from the interviews confirmed that inadequate human resources and low level of training are constraints affecting the public agricultural research system in Jamaica. Research personnel stated that not all researchers are adequately trained to conduct research; some researchers are lacking a strong agricultural background. The researchers felt that a need exists for additional human resources in research, especially professional staff. Some researchers mentioned that the system does not necessarily need more personnel, but needs a more efficient system, including competitive salaries and a larger research budget. However, the general
consensus among the research personnel interviewed was that additional staff with advanced degrees was needed.

Some of the researchers believed that improving the public research system in Jamaica will be difficult to achieve since the system cannot retain highly qualified personnel, due to low salaries and a decline in program resources. The most qualified researchers (i.e., Ph.D.s, M.S.) leave the public research system in search of higher salaries and benefits in the private sector. Therefore, attracting and retaining an adequate number of trained research staff will be a challenge.

Table 3 shows the ratio of research technicians to the total number of research scientists in the Jamaican Ministry of Agriculture. Technicians are defined as research personnel at the certificate and diploma levels and scientists are defined as research personnel at the bachelor, master and doctoral levels. Senior scientists accounted for 6% of the research staff, junior scientists comprised 13% of the staff, and professional agricultural researchers (B.S. level) and research technicians accounted for 59% and 22% respectively. Peterson et. al. (1989) stated that the optimal ratio of technicians to scientists is 2:1. However, in Jamaica the ratio is .28:1. Thus, the public research system in Jamaica is operating far below the ratio recommended for achieving maximum efficiency and output from the research system.

The researchers mentioned a shortage of technicians and stated that the system needs more technicians or research assistants. The system has been understaffed for the last 10 years and although laboratories and equipment are
Table 3

Technician Support Provided for Scientists and Technicians (1992)

<table>
<thead>
<tr>
<th>Categories</th>
<th>N</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Senior Scientists (Ph.D.)</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>Junior Scientists (M.S.)</td>
<td>4</td>
<td>13</td>
</tr>
<tr>
<td>Professional Agricultural Researchers (B.Sc.)</td>
<td>19</td>
<td>59</td>
</tr>
<tr>
<td>Research Technicians (Diploma/Certificical Level)</td>
<td>7</td>
<td>22</td>
</tr>
<tr>
<td><strong>Total Research Personnel</strong></td>
<td>32</td>
<td>100</td>
</tr>
</tbody>
</table>

Ratio = Number of Technicians/Total Research Personnel

.28:1

available, there are not enough qualified technicians and many research posts are unfilled.

**Objective 3: Assess Allocations to Research Salaries, Programs, and Capital Improvements**

Table 4 illustrates the percentage of the R&D Division's budget allocated to research salaries, programs, and capital investment for the past 10 years. Salary expenses include wages and benefits paid to research personnel. Research programs include all research activities (e.g., fertilizer trials, variety trials, demonstration plots, disease control, and training programs) research seminars, research publications, and any other activities contributing to research work. Capital investment includes building construction and acquisition of machinery and laboratory equipment. From 1983-1992, approximately 31% of the budget has been allocated to salaries, 42% has been allocated to research programs, and 27% to capital investment.

The percentage of the budget allocated to salaries increased marginally from 1983 to 1992. In 1985, the percentage for salaries reached its highest level at 36%. The percentage of the budget allocated to research programs increased from 32% in 1983 to 41% in 1992, with a high of 48% in 1985. Allocation to capital expenditures varied widely in the 10-year period, from a low of 16% in 1985 to a high of 42% in 1984.

According to Swanson and Peterson (1989) the ideal values for budget allocations have not been established, but the goal should be to have an equal allocation of resources between salaries and programs. When the proportion of the
Table 4

Budget Allocations to Research Salaries, Programs, and Capital (In $000)

<table>
<thead>
<tr>
<th>Year</th>
<th>Salaries</th>
<th>%</th>
<th>Programs Recurrent</th>
<th>%</th>
<th>Capital</th>
<th>%</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1983</td>
<td>4,258</td>
<td>27</td>
<td>5,113</td>
<td>32</td>
<td>6,630</td>
<td>41</td>
<td>16,001</td>
</tr>
<tr>
<td>1984</td>
<td>4,344</td>
<td>26</td>
<td>5,304</td>
<td>32</td>
<td>7,116</td>
<td>43</td>
<td>16,764</td>
</tr>
<tr>
<td>1985</td>
<td>4,986</td>
<td>36</td>
<td>6,650</td>
<td>48</td>
<td>2,200</td>
<td>16</td>
<td>13,386</td>
</tr>
<tr>
<td>1986</td>
<td>3,597</td>
<td>32</td>
<td>5,239</td>
<td>46</td>
<td>2,440</td>
<td>22</td>
<td>11,276</td>
</tr>
<tr>
<td>1987</td>
<td>4,108</td>
<td>31</td>
<td>5,703</td>
<td>43</td>
<td>3,403</td>
<td>26</td>
<td>13,214</td>
</tr>
<tr>
<td>1988</td>
<td>5,079</td>
<td>33</td>
<td>7,082</td>
<td>46</td>
<td>3,352</td>
<td>22</td>
<td>15,513</td>
</tr>
<tr>
<td>1989</td>
<td>5,567</td>
<td>31</td>
<td>7,363</td>
<td>42</td>
<td>4,800</td>
<td>27</td>
<td>17,730</td>
</tr>
<tr>
<td>1990</td>
<td>7,301</td>
<td>34</td>
<td>9,896</td>
<td>47</td>
<td>4,066</td>
<td>19</td>
<td>21,263</td>
</tr>
<tr>
<td>1991</td>
<td>5,975</td>
<td>32</td>
<td>8,900</td>
<td>47</td>
<td>4,000</td>
<td>21</td>
<td>18,875</td>
</tr>
<tr>
<td>1992</td>
<td>6,042</td>
<td>28</td>
<td>8,669</td>
<td>41</td>
<td>6,609</td>
<td>31</td>
<td>21,320</td>
</tr>
<tr>
<td></td>
<td>5,125</td>
<td>31</td>
<td>7,000</td>
<td>42</td>
<td>4,462</td>
<td>27</td>
<td>16,534</td>
</tr>
</tbody>
</table>

budget allocated to research programs falls below 40% of the overall recurrent budget, excluding capital expenditures, research productivity will be reduced. As shown in Table 5, the proportion of the recurrent budget allocated to research programs never fell below 54% between 1983 and 1992.

Many of the research personnel interviewed stated that they did not know what proportion of the research budget was applied to salaries, research programs, and capital investment. Others believed that more money is applied to salaries than to research programs. Some researchers stated that 70-90% of the research budget goes to salaries and that research programs are neglected. The general consensus of the research personnel interviewed was that too much of the budget was invested in salaries, while research programs were neglected.

Objective 4: Identify and Describe Resource Allocations to Commodity Research and Export Values of Selected Agricultural Commodities

Agricultural research in Jamaica is characterized by a dual structure: a) research on the principal export crops (e.g., sugar, coffee, bananas, and citrus) conducted by commodity boards which are legally under the Ministry of Agriculture, but have their own budget and research policies and b) research efforts devoted to domestic crops (e.g., yams, pumpkins, corn) and livestock, conducted under the auspices of the Ministry of Agriculture.

Table 6 illustrates the export values of six agricultural commodities grown mainly for export, three non-traditional export crops grown primarily for local
Table 5

Annual Research Allocations Excluding Capital Expenditures

<table>
<thead>
<tr>
<th>Year</th>
<th>Salaries</th>
<th>%</th>
<th>Programs</th>
<th>%</th>
<th>Total</th>
<th>% Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>1983</td>
<td>4,258</td>
<td>45</td>
<td>5,113</td>
<td>54</td>
<td>9,371</td>
<td></td>
</tr>
<tr>
<td>1984</td>
<td>4,344</td>
<td>45</td>
<td>5,304</td>
<td>55</td>
<td>9,648</td>
<td>3.0</td>
</tr>
<tr>
<td>1985</td>
<td>4,986</td>
<td>42</td>
<td>6,650</td>
<td>57</td>
<td>11,636</td>
<td>20.6</td>
</tr>
<tr>
<td>1986</td>
<td>3,597</td>
<td>40</td>
<td>5,239</td>
<td>59</td>
<td>8,836</td>
<td>-24.1</td>
</tr>
<tr>
<td>1987</td>
<td>4,108</td>
<td>41</td>
<td>5,703</td>
<td>58</td>
<td>9,811</td>
<td>11.0</td>
</tr>
<tr>
<td>1988</td>
<td>5,079</td>
<td>41</td>
<td>7,082</td>
<td>58</td>
<td>12,161</td>
<td>24.0</td>
</tr>
<tr>
<td>1989</td>
<td>5,567</td>
<td>43</td>
<td>7,363</td>
<td>56</td>
<td>12,930</td>
<td>6.3</td>
</tr>
<tr>
<td>1990</td>
<td>7,301</td>
<td>42</td>
<td>9,896</td>
<td>57</td>
<td>17,197</td>
<td>33.0</td>
</tr>
<tr>
<td>1991</td>
<td>5,975</td>
<td>40</td>
<td>8,900</td>
<td>59</td>
<td>14,875</td>
<td>-13.5</td>
</tr>
<tr>
<td>1992</td>
<td>6,042</td>
<td>41</td>
<td>8,669</td>
<td>58</td>
<td>14,711</td>
<td>-1.1</td>
</tr>
</tbody>
</table>

Table 6

Resource Allocations to Agricultural Commodities and Export Values (In $000)

<table>
<thead>
<tr>
<th>Commodity</th>
<th>Export Value</th>
<th>Ministry of Agriculture Research</th>
<th>Ministry of Agriculture Research</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Staff Allocated to Commodity</td>
<td>Budget Allocated to Commodity</td>
</tr>
<tr>
<td></td>
<td>N</td>
<td>%</td>
<td>#</td>
</tr>
<tr>
<td>Sugar</td>
<td>93,381</td>
<td>53</td>
<td>0</td>
</tr>
<tr>
<td>Banana</td>
<td>45,207</td>
<td>25</td>
<td>0</td>
</tr>
<tr>
<td>Coffee</td>
<td>12,035</td>
<td>7</td>
<td>0</td>
</tr>
<tr>
<td>Pimento</td>
<td>3,500</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Citrus</td>
<td>3,414</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Cocoa</td>
<td>2,301</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Yams</td>
<td>9,130</td>
<td>5</td>
<td>3</td>
</tr>
<tr>
<td>Pumpkins</td>
<td>1,442</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Mangoes</td>
<td>1,382</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Other**</td>
<td>5,833</td>
<td>3</td>
<td>25</td>
</tr>
<tr>
<td>Total</td>
<td>177,625</td>
<td>100</td>
<td>32</td>
</tr>
</tbody>
</table>

* Data on the breakdown of allocation to each commodity is not available.

** Other: Papaya, avacados, melons, ginger, cereals, potatoes, livestock research.

consumption, the number of public research staff allocated to each commodity, and the percentage of the public research budget allotted to each commodity. As shown in Table 6, the total value of agricultural exports for 1991 was approximately US$178 million. Sugar was the largest export crop, followed by bananas and coffee. Citrus and pimento contributed small percentages to the export values. Table 6 also shows that non-traditional export crops, such as yams, pumpkins, and mangoes contributed 7% to the export values of the country (Economic and Social Survey of Jamaica, 1992).

The allocation of resources to different commodity programs is an indicator of priorities within the public research system. The focus of a research program is measured by the percentage of the export values, percentage of the research budget, and the number of research staff assigned to each commodity. The amount of investment in a particular commodity should coincide with its importance to the agricultural economy (Swanson & Peterson, 1989).

According to Swanson and Peterson (1989) examination of the proportion of financial and human resources invested in each commodity research program in relation to the economic contribution of each commodity to the AGDP can determine if a serious imbalance exists in the research system. A 1:1 investment ratio is ideal but not assumed to be optimal. However, major divergence from this ratio would suggest a possible mis-allocation of resources between export and domestic commodity research.
When agricultural researchers were asked to discuss how resources are allocated between export and domestic commodities, they indicated that the Ministry of Agriculture has invested too much money in traditional export commodities to secure foreign exchange; research on domestic commodities is neglected in favour of the large farm sector. The general concern is that adequate resources have not been invested in local food crop research to increase productivity, even though local food crops produced by small-scale farmers are consumed on a larger scale. The researchers stated the need for more cropping systems research focusing on small landholders and more adaptive research for domestic commodities.

Responses to Open-ended Questions

In addition to the questions pertaining to the indicators, researchers were asked to address the following questions: a) what type and extent of interaction do they have with extension personnel and farmers, b) how do they prioritize their research agenda, c) what role does research play in the technology transfer process, d) what is the ideal technology transfer model, e) what is the relationship between research and extension, and f) what recommendations do they have for improving the research-extension linkage.

(a) "What type and extent of interaction do researchers have with extension?"

The responses from the interviews indicated that the interaction between researchers and extension agents is often initiated by the extension service and
researchers are not expected to contact the extension agents directly. For example, researchers stated that they only interact with extension personnel at field days held by extension or when they are invited by extension to discuss research findings. Occasionally extension subject matter specialists inform research stations of specific problems in the field, but direct contact is limited. Other researchers stated that there is no formal structure in place to facilitate frequent interaction between research and extension; they interact through their own informal networks.

Responses from the interviews suggest that direct contact occurs between researchers and farmers, but the contacts are more frequently initiated by the farmers. Interaction between researchers and farmers is not formalized, they seem to be fragmented, and are only based on requests made by the farmers. Many researchers stated that interaction with farmers only takes place at the level of validation trials, field days, and other occasions where farmers provide land for research activities and other instances in which contact is made with the larger farmers.

(b) "How do researchers prioritize their research agenda?"

The overwhelming response to this question indicated that the research agenda is set by government policy through the government's five-year plan. The research emphasis in the five-year plan has shifted between export and domestic commodities over the years depending on governmental priorities and the economic conditions of the market. Researchers noted that occasionally contact is made with other research institutions to avoid duplication of research activities.
(c) "What is the relationship between research and extension?"

When researchers were asked about the relationship between research and extension their responses indicated that there are no clear policies for establishing a research-extension linkage, primarily due to the lack of a strong bond at the administrative levels. Therefore, research and extension do not work together at the initiation stage of technology development which makes it more difficult to expect linkage at the critical points of the transfer process. The general view is that extension agents are not perceived as change agents, but as government officers being used to distribute government programs. Researchers stated that research has a different focus and a different mission than the extension service, and most researchers are not aware of most extension programs. Research results are not frequently made available to extension personnel in a form appropriate for transfer to farmers. Both systems are plagued with a tradition of isolation and territorial problems.

Other responses indicated that the major problems associated with the research-extension linkage is the nature of their activities, lack of structure, limited transportation, lack of recognition of extension agents, and the long tradition of operating as separate institutions. Some research results are inconclusive and irrelevant to farmer needs and extension is frequently blamed for the failure of farmers to adopt new innovations.
(d) "What is the ideal technology transfer model?"

The researchers were asked to draw their perception of the ideal technology transfer model. The seven models are located in Appendix G (Models 1-7).

Most models (five out of the seven) used at least four levels of personnel in the transfer process: the researcher, the subject matter specialist, the extension agent, and the farmer. Two models did not include the subject matter specialist. Three of the seven models utilized a top-down structure. That is, the flow of information is in one direction only (i.e., from the R&D Division to the farmer, through the extension agent and/or the subject matter specialist). Three models had some form of feedback mechanism between the different levels of the models, mainly through field days and on-farm trials. All seven models had the researcher as the source of technology. However, two of the models recognized the possibility of technology coming from outside the public research system for adaptation by the researcher.

(e) "What role does research play in the technology transfer process?"

When researchers were asked to define the role of research in the technology transfer process, their responses indicated that most researchers saw their role as developing new production and breeding techniques, improving various cultural practices, developing new pesticides/insecticides, and then passing on the information to the extension service for dissemination to the farmers. The researchers did not show much concern for how and in what form the new information would get to the farmers. There are no direct routes for researchers to provide research findings to the extension service. They felt that the role of research is limited to technology
development. As a result, extension agents were seen as responsible for interpreting and simplifying the information in a manner that is practical and useful to the farmer. Researchers are to provide solutions to research problems and publish research findings.

(f) "What recommendations do researchers have for improving the research-extension linkage?"

The responses from the interviews indicated that a comprehensive research program based on research problem areas, closely coordinated with extension is needed to improve the research-extension linkage. Research objectives should be identified and various procedures should be implemented to improve the availability of research findings from the research system to extension and farmers. A closer working relationship between research, extension, and farmers should be established at the initiation stage of technology development to encourage recognition, trust, and greater participation of farmers and extension. Joint training courses, meetings, and seminars should be encouraged to provide adequate opportunity for the exchange of suggestions for new research activities and the update of research findings.

Researchers felt that a more defined framework is needed to include all groups involved in the research process. A documentation unit is needed to interpret and report research findings to extension and farmers in a timely manner. Some type of joint committee is needed to develop research priorities and research training sessions to reflect extension activities. All of the researchers agreed that the extension and research systems should meet more frequently to discuss relevant problems.
CHAPTER VI

ANALYSIS OF THE
JAMAICAN PUBLIC EXTENSION SYSTEM

Introduction

The job of the public technology transfer system in Jamaica is complex due to the diversity of crops and agro-climatic zones, and a dualistic economy comprised of small farms producing primarily for the domestic market and large farms producing for both domestic and export markets. The extension system serves over 180,000 farmers most of whom are small farmers. The Rural Agricultural Development Authority (RADA) of the Ministry of Agriculture is currently responsible for technology transfer.

Fourteen extension professionals were interviewed as a source of primary data to supplement the data gathered by the indicators (see Appendix F). The extension professionals interviewed ranged from the chief administrators in the public extension system to agricultural assistants at the field level.

The main focus of this chapter is on the knowledge transfer system provided by the Jamaican Ministry of Agriculture through RADA. The chapter is organized
as follows: a) historical perspective, b) background of the current knowledge transfer system, c) organizational structure, d) discussion and summary of the indicators that measure the performance of the extension system, including a summary of the comparative data based on similar studies conducted by Sands, Peterson and Swanson (1989), and e) a summary of the responses to the open-ended questions that addressed the public extension system in Jamaica.

**Historical Overview**

The Jamaican Extension Service has experienced several periods of re-organization and re-structuring, and government officials continue to search for an extension service that better assists farmers.

Agricultural extension in Jamaica formally began in 1895. The initiative was taken by the Jamaica Agricultural Society (JAS) for the purpose of disseminating agricultural information to farmers, serving as a liaison between the government and farmers, and watching over the interests of the agricultural industry.

District branches of the JAS were established nationwide, through which extension agents made contact with farmers in a specific area. Field demonstrations and branch meetings were the main methods used by the JAS to transfer information to farmers in the early years. Group activities were usually arranged with several district branches so that many farmers could benefit from a single group activity (Henry & Johnson, 1979).
Integration: 1951-1955

The JAS could no longer handle the demands on its extension services, so in 1951, most of the extension services provided by the JAS were transferred to the Department of Agriculture. The major functions of the new extension system were mainly advisory and procurement of farm inputs. The focus of the newly integrated extension service was to assist farmers in developing comprehensive farm plans in an effort to improve productivity.

The research and extension linkage was also initiated in 1951. The officers in charge of research reported to the divisional extension officers in the extension service to ensure that the research department developed projects that were relevant to farmers. Extension officers worked with the researchers to provide feedback on results for use by farmers (Henry & Johnson, 1979).

Co-ordination: 1955-1964

In 1955, a committee was established to co-ordinate the extension services among conflicting agencies. The committee consisted of representatives from the forestry, extension, and co-operatives departments, the agricultural credit board, the 4-H clubs, the JAS, and the Jamaica Social Welfare Commission.

An assessment of the system was undertaken by the committee and the following guidelines for co-ordination were recommended: definition of an appropriate policy for agriculture and rural development, definition of the areas of responsibilities for respective departments, consolidation of departmental programs
and constant government evaluation at all levels of the extension program to ensure co-ordination among all agencies involved.

**Re-organization: 1964-1969**

The extension service was again re-organized to separate knowledge transfer activities from the administration of government programs. Two separate service units were developed and co-ordinated by the director of extension. One unit was educational and had the responsibility for staff and farmer training, and the other unit was primarily responsible for administering government programs such as special surveys, agricultural credit schemes, food crop subsidy, and farm building schemes (Henry & Johnson, 1979).

**Re-organization: 1969-1972**

In 1967, the Ministry of Agriculture and Lands was divided into the Ministry of Agriculture and Fisheries and the Ministry of Rural Lands Development. The educational services were transferred to the Ministry of Agriculture and Fisheries and the regulatory functions were transferred to the Ministry of Rural Lands Development.
Integration: 1972-1977

The Ministry of Agriculture and Fisheries and the Ministry of Rural Lands Development rejoined in 1972 to form the current Ministry of Agriculture, in which the current extension system resides. (University of Kentucky 1979).

Re-structuring: 1977-1978

In 1977, the Ministry of Agriculture was restructured in an effort to improve the effectiveness of the Ministry as an implementing agency. The main objectives were re-organization of its research and extension services, strengthening the institutional aspects of the research services, implementing extension training programs, and strengthening the agricultural information service.

It was recommended that extension specialists (SMSs) be stationed at the regional experiment stations to follow closely the research work in progress, maintain personal contact with the researchers and plan together, with researchers the transfer of research results to farmers and provide specialized support to extension officers in implementing new innovations. Research findings were to be tested under actual farming conditions prior to recommendation to farmers, and the results were to be evaluated within the framework of the appropriate farming systems (FAO, 1979). The extension service is currently going through a third phase of a major re-organization (1990-1995).
Overview of the Current Extension Organization

Extension services in Jamaica are currently provided by the technical service unit of the Rural Agricultural Development Authority (RADA). RADA is one of several units in the Ministry of Agriculture that plays an important role in improving the economic development of the agricultural sector. Other specialist areas in the Ministry of Agriculture include market intelligence, rural infrastructure, and watershed management. RADA was created in 1990, under the Ministry of Agriculture, as a statutory body designed to provide a new dynamism, positive change, and productive directions needed for the extension service to function effectively. RADA currently has 120 extension officers compared with 240 in 1982, with over half of the agricultural assistant positions eliminated. Further reductions in staff are anticipated in 1993.

The primary goal of RADA is to serve small and medium size farmers in the rural areas in an effort to enhance farmer productivity and income, while at the same time fostering the development of rural infrastructure and meeting farm family social needs. RADA seeks to enhance the development of farms through an effective, efficient, and sustainable extension service and provide technical advice to farmers (RADA, Report 1990-91).

To accomplish its mandate, RADA pursues the following objectives:

a) provide a technical agricultural extension advisory service primarily to farmers in rural areas to increase productivity, b) administer farmer training programs, thereby
rendering farmers more knowledgeable and capable, c) assist small farmers in organizing co-operative marketing ventures, and disseminate marketing information to farmers, d) cooperate with agencies involved in the development of rural infrastructure with a view to improve the quality of life in rural communities, e) develop and operate rural agricultural service centres at strategic locations, thereby bringing service to the farmers, f) cooperate with agricultural research organizations to provide a technology delivery link to rural farmers, and g) provide a channel for the free flow of information from farmers to policy makers.

In the performance of its functions, RADA works closely with other organizations and agencies such as the National Water Commission, the National Irrigation Commission, the Ministry of Construction, the JAS, and the National Agricultural Research and Development Institute. This integrated approach assists in the provision of infrastructure and social services which are necessary to supplement agricultural development.

**Organizational Structure**

Figure 3 represents the organizational structure of RADA. RADA is headed by a board of directors. The board consists of 15 members, who report to the Minister of Agriculture, an elected Member of Parliament. The executive director has overall responsibility and authority for the efficient management of extension activities at the regional and parish levels. The national director-technology transfer
Figure 3. Rural Agricultural Development Authority.
has responsibility of overall co-ordination of regional extension services and providing guidelines in compliance with government policies, and reports to the executive director. There are three regions headed by regional directors who report to the national director-technology transfer (RADA, 1990).

Each region comprises of a number of parishes headed by parish agricultural managers and deputies. The parish managers report to the regional director and have overall responsibility of implementation of extension programs within the parish. The office of the parish manager provides direct services to farmers.

The parish is divided into extension areas headed by extension officers. The extension officer serves as a direct contact with the farming community. He or she serves as a technical advisor in areas of farm planning, credit, and production input. Extension officers are assisted by agricultural assistants at the local level.

Technology Transfer Indicators

The following section addresses the six indicators that measure the factors that affect the performance of the Jamaican public extension system. These indicators are: access to and availability of internal technology from agricultural research, human resources for the public agricultural extension system in Jamaica, examination of personnel evaluation and supervision for the public extension system, the time allotted by Jamaican extension officers to the transfer of agricultural technology, the allocation of financial resources between extension salaries, programs, and capital,
and a description the technology transfer activities used by Jamaican extension officers.

Objective 5: Access to and Availability of Internal Technology from Agricultural Research

Table 7 examines the types and frequency of contacts between research and extension. The contact rating for this measure ranges from 0 (no contact) to 3 (high level of contact). The data presented in Table 7 show a low level of contact in the area of visits to research stations by extension personnel, on-farm trials, training sessions and workshops on new technology, and joint research-extension meetings on technical recommendations. The maximum cumulative index score that can be obtained using this measure is 15. The cumulative index score obtained in this study was five. A cumulative score of five or less indicates weak linkage between research and extension; a score of one or less for each type of contact indicates weakness in the system (Swanson & Peterson, 1989).

Table 8 identifies the types of contact that take place between research and extension personnel as perceived by administrators in the two systems. Seven types of contacts are listed and an indication of whether interaction is currently occurring between the systems. As indicated in the table, the administrators disagreed on the type of interaction occurring between the two systems on four of the activities. The table also shows that both directors agreed that interaction between the systems had occurred for participation in field days and collaboration on technical publications.
Table 7

Access to Technology from Research (n = 6)

<table>
<thead>
<tr>
<th>Type of Research - Extension Contact</th>
<th>Mean Contact Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visits to research stations by extension personnel</td>
<td>1</td>
</tr>
<tr>
<td>On-farm trials/demonstrations conducted jointly by research and extension</td>
<td>1</td>
</tr>
<tr>
<td>Technical and related publications from research to extension</td>
<td>1</td>
</tr>
<tr>
<td>Training sessions or workshops on new technology</td>
<td>1</td>
</tr>
<tr>
<td>Joint research-extension meetings on technical recommendations and to plan and review</td>
<td>1</td>
</tr>
<tr>
<td>joint activities</td>
<td></td>
</tr>
<tr>
<td>Total Index Score</td>
<td>5</td>
</tr>
</tbody>
</table>

*Note:* 0 = No Contact; 1 = Low Level Contact; 2 = Moderate Contact; and 3 = High Level Contact.

Table 8

Interaction Between Research and Extension Personnel

<table>
<thead>
<tr>
<th>Types of Interaction</th>
<th>Extension Director</th>
<th>Assistant Research Director</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annual meeting to discuss recommendations</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Annual meeting to discuss farmers' problems for which answers are not known</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Researchers who participate in extension training programs</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Research and extension personnel collaborating on field trials and demonstrations</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Field days at research centers for extension personnel</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Technical publications issued by research or extension with review or collaboration</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>

Source: Interviews with the Extension Director (RADA) and the Assistant Director of Research and Development (R & D), Ministry of Agriculture, Hope Gardens, Kingston, Jamaica.
Table 9 shows the types and frequency of formal contacts between research and extension for the purposes of feedback. Four types of contact and the frequency of each contact are tabulated. The data indicate that formal meetings between research and extension administrative personnel are held two to three times per year. However, these meetings are usually of an ad-hoc nature. According to the two directors, joint meetings with technical research and extension personnel are held quarterly, joint on-farm demonstrations are on-going and joint workshop/training sessions directly involving research and extension personnel are held on an ad-hoc basis.

Extension personnel were asked what type and extent of interaction they have with researchers. Their responses indicated that the interactions are very informal and are not institutionalized. However, efforts are now being made to formalize the interaction through frequent research-extension meetings and seminars. Visits by extension personnel to research station occur only on a limited basis. Other types of contact, including field days, seminars, and training courses, also occur on a limited basis. A few extension personnel are working at various research stations to improve the research extension linkage.

Objective 6: Human Resources for Public Agricultural Extension System in Jamaica

Table 10 illustrates the ratio of extension agents to farmers in Jamaica. The data indicate that the current extension agent-to-farmer ratio for the public extension
Table 9

Formal Contacts Between Research and Extension for Purposes of Feedback (n = 2)

<table>
<thead>
<tr>
<th>Types of Formal Contact</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meetings between administrative personnel</td>
<td>2 to 3 times per year ~ ad hoc</td>
</tr>
<tr>
<td>Meetings between technical personnel</td>
<td>Quarterly</td>
</tr>
<tr>
<td>Joint on-farm trials demonstrations</td>
<td>On-going</td>
</tr>
<tr>
<td>Workshops-training sessions directly involving research personnel</td>
<td>No set time</td>
</tr>
</tbody>
</table>

Source: Interviews with the Extension Director (RADA) and the Assistant Director of Research and Development (R & D), Ministry of Agriculture, Hope Gardens, Kingston, Jamaica.

Table 10

Extension Agent-to-Farmer Ratio (1992)

<table>
<thead>
<tr>
<th>Number of Field Agents</th>
<th>Number of Farmers</th>
</tr>
</thead>
<tbody>
<tr>
<td>134</td>
<td>180,000 - 7% of total population</td>
</tr>
</tbody>
</table>

Ratio = Agents:Farmers 1:1,343 Ratio

system is 1:1,343. Due to downsizing and restructuring, the projected ratio of extension agent to farmers in 1993 will be 1:1,500.

The optimal ratio recommended by the World Bank (1985) using the Training and Visit (T&V) system is 1:800. A ratio greater than 1:800 is perceived to be a problem for many countries because it leads to lower levels of contact or coverage between extension agent and farmers, as well as greater expenditures for agent mobility and an increased tendency for extension agents to contact larger commercial farmers (Swanson & Peterson, 1989).

Table 11 shows the percentage of subject matter specialists (SMSs) to the professional extension staff. The percentage of SMSs between 1988-1993 was about 5% except for 1992 when the percentage fell to 3%. The recommended percentage under the T&V system is 12-15%. Such a low level of SMSs indicates serious constraints within the Jamaican Extension system (Swanson & Peterson, 1989).

The data in Table 12 show the educational levels, percentages and total number of extension staff at each educational level in the public extension system over the last nine years. In 1983, the public extension system had 253 extension personnel, but 10 years later, the number decreased by 38% to 157. The decrease in the later years is due to the restructuring and reorganizing of the Jamaican extension service. Further reduction in the extension staff is also projected for 1993. For example, extension personnel with two-year diplomas will be reduced from 73 to 60 in 1993. However, the percentage of extension personnel within each educational level has remained fairly constant from 1982 to 1991. The data show a
Table 11

Percentage of Subject Matter Specialists Among the Professional Field Staff

<table>
<thead>
<tr>
<th>Year</th>
<th>SMS</th>
<th>Professional Field Staff</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>1988</td>
<td>12*</td>
<td>228</td>
<td>5</td>
</tr>
<tr>
<td>1989</td>
<td>12</td>
<td>228</td>
<td>5</td>
</tr>
<tr>
<td>1990</td>
<td>8</td>
<td>151</td>
<td>5</td>
</tr>
<tr>
<td>1991</td>
<td>8</td>
<td>162</td>
<td>5</td>
</tr>
<tr>
<td>1992</td>
<td>3c</td>
<td>96</td>
<td>3</td>
</tr>
<tr>
<td>1993*</td>
<td>3</td>
<td>60</td>
<td>5</td>
</tr>
</tbody>
</table>

Note: * projected for FY 1993, * denotes regional level, * denotes national level.

Table 12

Educational Levels of Extension Personnel

<table>
<thead>
<tr>
<th>Year</th>
<th>Postgraduate</th>
<th>B.Sc. Degree or Equivalent</th>
<th>Associate of Science Degree - 3 Years (ASD)</th>
<th>Two-Year Diploma</th>
<th>Two Year Certificate</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Ph.D. n %</td>
<td>M.S. n %</td>
<td>n %</td>
<td>n %</td>
<td>n %</td>
<td></td>
</tr>
<tr>
<td>1983</td>
<td>0 0 1 3</td>
<td>24 9</td>
<td>1 3</td>
<td>205 81</td>
<td>22 8</td>
<td>253</td>
</tr>
<tr>
<td>1984</td>
<td>0 0 1 3</td>
<td>25 9</td>
<td>2 7</td>
<td>205 80</td>
<td>23 8</td>
<td>256</td>
</tr>
<tr>
<td>1985</td>
<td>0 0 1 3</td>
<td>27 10</td>
<td>2 7</td>
<td>207 79</td>
<td>23 8</td>
<td>260</td>
</tr>
<tr>
<td>1986</td>
<td>0 0 1 3</td>
<td>29 11</td>
<td>2 7</td>
<td>207 79</td>
<td>23 8</td>
<td>262</td>
</tr>
<tr>
<td>1987</td>
<td>0 0 1 3</td>
<td>29 11</td>
<td>0 0</td>
<td>199 78</td>
<td>23 9</td>
<td>252</td>
</tr>
<tr>
<td>1988</td>
<td>0 0 0 0</td>
<td>27 10</td>
<td>1 3</td>
<td>200 79</td>
<td>23 9</td>
<td>251</td>
</tr>
<tr>
<td>1989</td>
<td>0 0 0 0</td>
<td>27 10</td>
<td>4 1.5</td>
<td>197 78</td>
<td>23 9</td>
<td>251</td>
</tr>
<tr>
<td>1990</td>
<td>0 0 3 .9</td>
<td>18 6</td>
<td>0 0</td>
<td>130 43</td>
<td>150 49</td>
<td>301</td>
</tr>
<tr>
<td>1991</td>
<td>2 1 7 2</td>
<td>23 9</td>
<td>0 0</td>
<td>130 44</td>
<td>130 44</td>
<td>292</td>
</tr>
<tr>
<td>1992</td>
<td>2 1 5 3</td>
<td>16 10</td>
<td>0 0</td>
<td>73 46</td>
<td>61 38</td>
<td>157</td>
</tr>
</tbody>
</table>

marginal increase in educational levels in the extension system, especially at the post-graduate level.

The responses from the interviews indicated that extension agents at all levels were perceived to have the basic academic training to perform their duties. However, academic preparation needs to be reinforced with practical and technical training in specific areas, such as extension methodology. Extension personnel are hired based on specific requirements, but formal orientation of new extension personnel and frequent in-service training is required to keep agents knowledgeable and up to date with new information. The general feeling expressed by the extension personnel interviewed is that extension professionals are not highly knowledgeable in areas such as extension methodology and the overall extension approach. Additional in-service education is required to offset these short comings.

Objective 7: Examination of Personnel Evaluation and Supervision for the Public Extension System

The data in Table 13 identify personnel evaluation and supervisory procedures used in extension system. The table consists of four major categories of questions covering evaluation procedures, supervision, positive incentive criteria, and negative sanction criteria. The list consists of 17 questions which require either a yes or no response to determine if recommended procedures are used to evaluate extension personnel. Under the category of evaluation procedures, seven responses indicated that recommended evaluation procedures are currently being used as a management
Table 13

Personnel Management Procedures Used in the Extension System (n = 7)

<table>
<thead>
<tr>
<th>Item</th>
<th>No</th>
<th>Yes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Evaluation Procedures</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Are there written and distributed evaluation procedures and criteria?</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>Is there an annual written evaluation on each staff member?</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>Do different supervisory levels have input into the evaluation?</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>Are field assistants notified of evaluation results?</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>Do evaluation procedures involve follow-up counseling or training when needed?</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td><strong>Supervision</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Is there a reasonable ratio of supervisors to field staff?</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>Are supervisors instructed to observe performance and provide counseling?</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>Do supervisors prepare written evaluations and discuss them with employees?</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td><strong>Positive Incentive Criteria</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Is pay distributed on a merit basis?</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>Does a considerable range in salary exist based solely on performance?</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>Does extra training result in higher pay for the same job?</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>Are promotions based on performance?</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>Are supervisors encouraged to recognize and commend excellent work on the job?</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td><strong>Negative Sanction Criteria</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Does the system provide informal feedback on poor performance?</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>Does the system provide for written reprimands?</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>Does the system provide for punishment such as loss of pay or demotion?</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>Does the system dismiss employees for incompetence that cannot be corrected?</td>
<td>7</td>
<td></td>
</tr>
</tbody>
</table>


practice. On the question of whether evaluation procedures involve follow-up counselling or training when needed, four responses indicated that this procedure is not used to evaluate extension personnel. In the supervision category, all seven
responses indicated that recommended supervisory policies are followed by the extension system. In the positive incentive criteria category, all the responses indicated that positive incentives are not used to evaluate extension personnel. The responses from the negative sanction criteria category indicate that this management procedure is being used to evaluate extension personnel.

Extension personnel were asked for their perceptions of the evaluation procedures used and the adequacy of their supervision. Most of the extension professionals indicated that the current evaluation procedures were fair because feedback is provided by supervisors and personnel are allowed to discuss their concerns and provide their own input into the evaluation process. The system facilitates supervision but it is not well organized at all levels. If evaluation and supervision procedures are to be effective they should reflect rewards for good performance and penalties for poor performance. Some extension personnel stated that although evaluation procedures are in place, they are not always followed and feedback is not provided.

**Objective 8: Determine the Time Allotted by Jamaican Extension Officers to the Transfer of Agricultural Technology**

Table 14 shows the average amount of time field agents spend on educational duties to the total time spent on non-educational activities. The table shows three groupings of extension duties and responsibilities commonly carried out by extension agents and the average percent of time devoted to each category per extension agent and agricultural assistants. Extension agents devoted an average of 12% of their time
Table 14

Time Allocated to Technology Transfer

<table>
<thead>
<tr>
<th>Duties and Responsibilities of Extension Field Personnel</th>
<th>% of Time Spent</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Extension Officers</td>
</tr>
<tr>
<td>Non-knowledge Transfer Activities</td>
<td>12</td>
</tr>
<tr>
<td>Knowledge Transfer Activities</td>
<td>63</td>
</tr>
<tr>
<td>Planning and Support Activities</td>
<td>25</td>
</tr>
</tbody>
</table>


To non-knowledge transfer activities, 70% to transfer activities, and 18% to planning and support activities. Non-knowledge transfer activities included regulatory work, data collection, work on government programs and servicing local government. Transfer activities included planning and conducting on-farm extension visits, educational meetings, field days and group activities, and other educational activities. Planning and support activities included preparing administrative reports and attending in-service training.

Most extension personnel interviewed stated that they have adequate time to perform educational activities, but educational equipment and other resources such as transportation are not always available. Previously, more emphasis was placed on non-educational activities but since the reorganization and restructuring of the extension system in 1990 more emphasis is being placed on educational programs for
farmers. However, extension personnel stated that educational programs are poorly implemented, there is little follow up of previous programs, and there is no systematic means of planning or evaluating educational activities. Extension personnel consider all activities done with farmers as educational. Administrative duties are usually performed once per week.

**Objective 9: Assess Allocation of Financial Resources Between Extension Salaries, Programs and Capital**

Table 15 shows the amount and percentage of the total extension budget for salaries, program operations, and capital maintenance for the last 11 years. Salary expenses include wages and benefits paid to extension personnel. Extension programs include all sources of knowledge transfer - extension seminars, workshops, meetings, exhibits, radio farm shows, and any other activities contributing to knowledge transfer. Capital maintenance includes building repairs, construction, acquisition of machinery, and transportation. From 1982-1992, the percentage of the budget spent on programs increased, while capital expenditures decreased.

Many of the extension personnel interviewed stated that they did not know what proportion of the extension budget was applied to salaries, extension programs, and capital investment. Some extension personnel stated that more money is applied to salaries but the amount is inadequate when compared to salaries paid by comparable institutions. Others believed that not enough money is applied to extension programs in relation to the amount applied to salaries and that the program budget is constrained by inadequate financial resources.
Table 15

<table>
<thead>
<tr>
<th>Year</th>
<th>Salaries</th>
<th>%</th>
<th>Operations</th>
<th>%</th>
<th>Capital</th>
<th>%</th>
<th>Total Budget</th>
</tr>
</thead>
<tbody>
<tr>
<td>1982</td>
<td>34,548,237</td>
<td>32</td>
<td>13,210,373</td>
<td>12</td>
<td>60,670,100</td>
<td>56</td>
<td>108,428,710</td>
</tr>
<tr>
<td>1983</td>
<td>35,246,422</td>
<td>38</td>
<td>15,326,286</td>
<td>16</td>
<td>42,582,422</td>
<td>46</td>
<td>93,155,130</td>
</tr>
<tr>
<td>1984</td>
<td>34,603,000</td>
<td>55</td>
<td>16,397,000</td>
<td>26</td>
<td>11,915,000</td>
<td>19</td>
<td>62,915,000</td>
</tr>
<tr>
<td>1985</td>
<td>28,097,000</td>
<td>48</td>
<td>20,253,000</td>
<td>35</td>
<td>10,000,000</td>
<td>17</td>
<td>58,350,000</td>
</tr>
<tr>
<td>1986</td>
<td>26,094,000</td>
<td>36</td>
<td>24,542,500</td>
<td>34</td>
<td>21,835,000</td>
<td>30</td>
<td>72,471,5005</td>
</tr>
<tr>
<td>1987</td>
<td>29,118,000</td>
<td>31</td>
<td>37,382,000</td>
<td>39</td>
<td>28,950,000</td>
<td>30</td>
<td>95,450,000</td>
</tr>
<tr>
<td>1988</td>
<td>36,239,000</td>
<td>33</td>
<td>42,921,000</td>
<td>39</td>
<td>30,070,000</td>
<td>28</td>
<td>109,230,000</td>
</tr>
<tr>
<td>1989</td>
<td>37,671,000</td>
<td>31</td>
<td>63,344,000</td>
<td>52</td>
<td>21,444,500</td>
<td>17</td>
<td>122,459,500</td>
</tr>
<tr>
<td>1990</td>
<td>35,342,000</td>
<td>34</td>
<td>41,826,000</td>
<td>41</td>
<td>24,772,000</td>
<td>24</td>
<td>101,940,000</td>
</tr>
<tr>
<td>1991</td>
<td>37,090,000</td>
<td>46</td>
<td>7,910,000</td>
<td>10</td>
<td>35,000,000</td>
<td>44</td>
<td>80,000,000</td>
</tr>
<tr>
<td>1992</td>
<td>31,022,000</td>
<td>47</td>
<td>17,062,000</td>
<td>26</td>
<td>18,060,000</td>
<td>27</td>
<td>66,084,000</td>
</tr>
</tbody>
</table>

11-Year Ave. | 39 | 30 | 31 |

Objective 10: To Describe the Technology Transfer Activities Used by Jamaican Extension Agents

Table 16 shows the total number of farmers, field agents, and the average number of farms visited annually per field agent. The public Extension system serves 180,000 farmers, has 134 field agents averaging 348 farm visits per agent per year. Thus, the number of farmers visited by the extension system in 1991-1992 was 46,632 or 26% of the total number of farmers.

Table 17 shows the type of group contacts and the total number of group activities completed annually by Extension agents. In 1991-1992, Extension agents conducted 656 field days and 422 field demonstrations, or 1,078 group activities.

The data in Table 18 show the average number of demonstrations completed annually by field agents and the average number of farmers who attended these demonstrations. The total number of field agents is 134 and the average number of demonstrations is 3 per field agent. The number of farmers that attended field demonstrations in 1991-1992 was 4,316 or 2% of the farm population.

Table 19 shows the percentage and average number of individual or group contacts made by extension agents to farmers. The number of farmers with direct extension contact is 76,069 or 42% of the total number of farmers.

Table 20 shows different types of media sources used by Extension and a rank ordering of the media sources by frequency of use. The type of media sources most frequently used by extension agents for transfer activities are flip charts and teaching aids followed by leaflets/fact sheets and exhibits at fairs and agricultural shows. The
Table 16

Percentage of Farmers Visited by Field Extension Personnel (1992)

<table>
<thead>
<tr>
<th>A. Average No. of Farm Visits per Agent</th>
<th>B. No. of Field Agents</th>
<th>C. Total No. of Farmers</th>
</tr>
</thead>
<tbody>
<tr>
<td>348</td>
<td>134</td>
<td>180,000</td>
</tr>
</tbody>
</table>

Total Number of Farm Visits = A x B = N  
348 x 134 = 46,632

% of Farmers Visited = N + C  
26%*

* Assumes some farmers have been visited more than once.


Table 17

Average Number of Group Farmer Contacts Initiated by Extension (1992)

<table>
<thead>
<tr>
<th>Type of Group Activity</th>
<th>Actual Number in 1992</th>
</tr>
</thead>
<tbody>
<tr>
<td>Field Days</td>
<td>656</td>
</tr>
<tr>
<td>Demonstrations</td>
<td>422</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>1,078</strong></td>
</tr>
</tbody>
</table>

### Table 18

**Average Number of Demonstrations Completed Annually Per Field Agent (1992)**

<table>
<thead>
<tr>
<th>Calculation</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Total No. of Demonstrations</td>
<td>422</td>
</tr>
<tr>
<td>B. Total No. of Field Agents</td>
<td>134</td>
</tr>
<tr>
<td>A divided by B</td>
<td>Average No. of Demonstrations per Agent, or 3</td>
</tr>
<tr>
<td>A. Total No. of Farmers</td>
<td>180,000</td>
</tr>
<tr>
<td>B. No. of Farmers Attending Demonstrations</td>
<td>29,437</td>
</tr>
<tr>
<td>B divided by A</td>
<td>% of Farmers Attending Demonstrations, or 2%'</td>
</tr>
<tr>
<td>Average Number of Farmers per Group Demonstration</td>
<td>10</td>
</tr>
<tr>
<td>* Assumes some farmers have attended more than one demonstration.</td>
<td></td>
</tr>
</tbody>
</table>


### Table 19

**Percentage of Farmers with Direct Extension Contact (1992)**

<table>
<thead>
<tr>
<th>Calculation</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Estimates of Farmers Contacted - (all forms of individual (46,632 and group (29,437) contact</td>
<td>76,069</td>
</tr>
<tr>
<td>B. Total Number of Farmers in Country</td>
<td>180,000</td>
</tr>
<tr>
<td>A divided by B</td>
<td>% of Farmers Contacted, or 42%'</td>
</tr>
<tr>
<td>* Assumes some farmers are contacted more than once.</td>
<td></td>
</tr>
</tbody>
</table>

Table 20

Rank Order of Media Sources Used by Extension (1992)

<table>
<thead>
<tr>
<th>Type of Media</th>
<th>Rank Order</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flip Charts/Teaching Aids</td>
<td>1</td>
</tr>
<tr>
<td>Leaflets/Fact Sheets</td>
<td>2</td>
</tr>
<tr>
<td>Exhibits, Ag Shows, &amp; Fairs</td>
<td>3</td>
</tr>
<tr>
<td>Extension Posters/Signs/Bill Boards</td>
<td>4</td>
</tr>
<tr>
<td>Bulletins</td>
<td>5</td>
</tr>
<tr>
<td>Weekly Newspaper Articles</td>
<td>6</td>
</tr>
<tr>
<td>Technical Radio Programs</td>
<td>7</td>
</tr>
<tr>
<td>Movies/VCR/TV Programs</td>
<td>8</td>
</tr>
</tbody>
</table>

media sources used least frequently by the extension service are movies, television programs, and technical radio programs.

Table 21 illustrates the percentage of the population listening to agricultural programs and the number and minutes of agricultural radio programs broadcast weekly. The data show that the listening population of agricultural programs is 850,000 (i.e., 35% of the population receive agricultural information by radio). There are 10 weekly broadcasts of agricultural information programs, at an average of 5 minutes per program for a total of 50 minutes of agricultural programs broadcasts weekly.

Extension personnel stated that the activities used to transfer information to farmers are adequate, but because of limited transportation and various inputs needed to conduct field days and demonstrations, some farmers can not be reached. Other extension personnel stated that various group approaches should be used because fact sheets and leaflets are not being used as frequently, rather farmers are being taught to search for their own information. The general feeling is that the methods to disseminate technical information used are effective, but extension agents will have to be more creative because resources needed to transfer technology are not always available.
Table 21
Percentage of Farmers with Radio Contact and Programming (1992)

A. Listening Population = 850,000  
B. Total Population = 2,435,800

Percentage of Total Population = A divided by B = % of Population Listening to Radio Broadcasts by the JIS, or 35%

Number and Minutes of Technical Farm Programs Broadcast Weekly by Jamaica Information Service

Number of National Broadcasts/Week = 10 x Number of Minutes/Broadcast = 5

Number of Minutes/Week, or 50 minutes

Source: Director, Jamaican Information Service (JIS), Kingston, Jamaica (1992).
Responses to Open-Ended Questions

In addition to the questions pertaining to the indicators, extensionists were asked to address the following questions: a) What role does extension play in the technology transfer process?, b) What is the relationship between extension and research?, c) Do you feel that extension salaries and benefits are comparable to professionals with the same educational background in other public or private institutions?, d) What is the ideal technology transfer model?, and e) What recommendations extension have for improving the research extension linkage?

(a) "What role does extension play in the technology transfer process?"

Extension personnel indicated that extension is responsible for modifying and adjusting new information to useful and practical recommendations for farmers. Extension agents frequently initiate the contact with researchers and other organizations to determine what new information is available and to determine the methods to be used to transfer this new information to the farmers. Extension plays the role of organizing group activities such as field days, demonstrations, on-farm trials, selection of key farmers as innovators of new technology, and initiate direct contact with farmers to disseminate new information. Extension was seen as the only vehicle of technology transfer and the main source of new information. Extension bridges the gap between research and farmers, providing direction for the use of new technology, and making follow-ups visits to observe the progress of on-farm trials.
(b) "What is the relationship between extension and research?"

The responses from the interviews indicated that the relationship between extension and research is based on informal networking and casual contact. Even though there is some formal contact at the administrative level, the information shared at the top level does not filter through the system. The extension-research relationship is not considered to be adequate because extension is not well informed about on-going research programs or planned research activities. Extension personnel view themselves as the agent of change, but they are not recognized by researchers as the main link between research and farmers.

Extension personnel felt that too much time lagged between problem identification and research results, and a lack of direct involvement of extension personnel in the research process. Only limited research is conducted on the crops grown by small farmers and not enough effort is devoted to disseminate new findings from research to extension. Some research findings are inappropriate and are not applicable to all farmers, the findings are site-specific, and therefore cannot be adopted throughout the country.

(c) "Do you feel that extension salaries and benefits are comparable to professionals with the same educational background in other public or private institutions?"

Many of the responses from the interviews indicated that extension professionals are not paid as well as extension personnel in the private agricultural sector. However, extension salaries are fairly comparable to other public institutions.
Some extension personnel stated that since the reorganization of the extension service in 1990, a new salary scale has been established which is higher than the civil service. Others stated that extension salaries have only improved marginally, and their salaries are at the lowest level in the public sector. The general feeling is that low extension salaries is a world-wide problem and most extension personnel remain in their job, not because of salary levels but because of commitment to their job.

(d) "What is the ideal technology transfer model?"

Twelve extension personnel were asked to draw their perception of the ideal technology transfer model (see Appendix G, Models 8-19). Most of the models had two or more levels of personnel involved in the technology transfer process. The levels included the researcher, the subject matter specialists, extension agents and/or farmers. Seven of the models did not include the SMSs. Five of the models depicted a top-down approach, i.e., the flow of information is in one direction only, from the research and development division to the farmer through the SMS and the extension officer. Seven models provided some form of feedback mechanism between the different levels in the model, mainly through on-farm trials, field days, and demonstrations.

All 12 models represented the extension officer as one of the main links in the technology transfer process. Seven models had the researcher as the only source of new technology while five models utilized a combination of sources such as books, journals, research stations, and SMSs. One model depicted the extension service as the only source of technology. Four models indicated that the most frequent method
of disseminating information to farmers was either through field days, on-farm trials, or demonstrations.

(e) "What recommendations do extension personnel have for improving the extension-research linkage?"

Extension personnel indicated that various procedures should be implemented to improve the coordination of research and extension activities and clear agendas should be set for research and extension personnel. Research programs should be jointly identified and priority given to the most immediate concerns with regards to agricultural development. Formal linkages should be implemented to ensure a quicker turn around between problem identification and research results. Closer working relationship between research and extension should be established to ensure feedback and frequent communication between extension, research, and farmers. Researchers should assist extension personnel in interpreting and modifying new innovations in a manner that is applicable to all farmers. Extension agents should be encouraged to visit research stations regularly to observe research activities and participate in research meetings. More time should be devoted to on-farm trials which would allow greater participation and support by all farmers. A more relevant research program is needed, one that is based on farmers’ needs, and printed information from research should be updated more frequently. The overall research quality should be improved, and incentives should be provided to motivate the interest of researchers towards domestic-oriented research.
CHAPTER VII
ANALYSIS AND INTERPRETATION OF THE DATA

Introduction

This chapter presents an analysis and interpretation of the findings of the study. The discussion of the data is based upon the objectives of the study. The chapter is organized as follows: examination of the objectives and comparison with similar studies, conclusions, implications and recommendations, and need for further study.

Examination and Comparison of Objectives

Objective 1: Access to External Sources of Technology and Knowledge

This objective examined the Jamaican public agricultural research system's access to external sources of technology and knowledge in the areas of genetic technology and IARC training and consultations. To rate the level of access to external technology, the following commodities were selected - legumes, root crops, cereal grains, papaya, beef, and dairy.
The need for access to external sources of technology has been identified in several studies. Swanson (1977) and Herdt and Anderson (1987) claim that IARCs provide national research scientists with "hands-on" research skills and experienced-based knowledge that are essential to produce and adopt improved technology. Also, Swanson and Peterson (1989), maintain that access to IARC information and scientists is an important means of accelerating and strengthening the technology development process of national research systems. Access to external technology significantly reduces the time and cost of developing suitable technology for adoption to local conditions (Peterson et al., 1989). Developing countries with limited resources should use IARCs to obtain new technologies and use their resources to channel technology to the farm level (Wortman, 1977).

Analysis of the data reveal that the overall access of the Jamaican public agricultural research system to external sources of knowledge in the areas of germ plasm and IARC training and consultation is extremely low. The total access rating score is 21 out of a possible 59. Legumes have the highest level of external access to genetic technology, moderate access to IARC training, and low access to IARC consultations. Papaya and dairy have no external access rating for genetic technology and low external access ratings to IARC training and consultations.

IARC training is the most frequently used source of external technology used by the Jamaican public agricultural research system followed by genetic technology and IARC consultations. IARC training may be favored because of the easy access to the Caribbean Agriculture Research Development Institute (CARDI) and other
organizations such as the Inter-American Institute for Co-operation on Agriculture (IICA) and the International Institute of Tropical Agriculture (ITTA). The responses from the interviews also support the low level of access to external knowledge. The respondents indicated that the public agricultural research system is not very effective in providing financial support for its researchers to participate in international research conferences, IARC training, and other international exchanges. International contacts are maintained by individual researchers who establish their own networks and maintain scientific contacts through in-country conferences with researchers from other countries and publications in scientific journals.

Similar studies in Mexico and Malawi indicate that researchers have high access to external sources of knowledge and technology. Favorable access may be due in part to the close proximity of Mexico and Malawi to a number of international research centers. Four commodities were studied in Malawi and the overall index score was 31 out of 36 which is considered very positive. Four commodities were also studied in Mexico and from a possible 36 points the rating score was 32 (Peterson et. al., 1989). Both studies examined the public and private research systems. In a previous study conducted by the University of Kentucky (1979), the private commodity boards in Jamaica had high access to external sources of agricultural technology. Thus the low rating in this study versus similar studies could be because only the public research system in Jamaica was examined.
Objective 2: Assess Personnel Resources for the Public Agricultural Research System in Jamaica

This objective examined the quality and availability of agricultural researchers and technical assistants in the Jamaican public agricultural research system. Two measures were used to determine how the research system is functioning in terms of human resources. The first measure examined the number and percentage of scientific personnel at different educational levels in the research system. This measure provided an evaluation of the adequacy of researchers and trends in the research capacity over the last seven years. The second measure examined the support provided to researchers of the public research system in the form of technicians. This measure provided the ratio of scientists to technicians in the system.

An adequate number of qualified and well-supported research staff is the basic resource for a successful research system. Without enough qualified research personnel, the research system is seriously handicapped in its ability to plan and execute strong research programs. The effectiveness of agricultural research programs depends on the educational background of its staff. Human resources for agricultural research is well documented in the literature as an essential requirement for an effective national research system. Trigo (1987) and Morgan (1984) identify a "critical mass" of experienced, highly trained scientists as an essential requirement to a successful agricultural research system.

A study conducted by the University of Kentucky (1979), concluded that Jamaica lacked both the qualitative and quantitative capacity or "critical mass" in the
agricultural research system. Elz (1984) argued that agricultural research needs a highly trained professional staff, including laboratory technicians, to generate efficient agricultural technology. The World Bank (1981) lends support to the idea of a "critical mass" of trained scientists capable of conducting effective research programs. The World Bank (1985) also noted that lack of competent technical assistants appears to be a constraint in conducting agricultural research in many countries.

Analysis of the data indicate that researchers with Bachelor's degrees form the foundation of the Jamaican public agricultural research system. When considering the total research staff, 8% have Doctoral degrees, 16% have Master's degree and 76% have Bachelor's degrees. Two research personnel at the doctoral level and two researchers at the Master's level work in administration as well as in a technical capacity.

Jamaica's technicians to scientist ratio of .28:1 is far below the recommended ratio of 2:1 (Oram, 1982; World Bank, 1981). Similar studies in Malawi, Ecuador, and Mexico revealed that the agricultural research systems have been operating below the recommended ratio for achieving maximum productivity. The ratio in Malawi was .67:1, Ecuador .35:1, and Mexico 1.5:1. In prior years, the technicians to scientist ratio in Jamaica was higher, the lower ratio in 1992 is due to the recent downsizing of the public research system.
Objective 3: Resource Allocation to Salaries and Programs

This objective examined the proportion of the research budget allocated to research programs, salaries, and operations in the Jamaican public agricultural research system over the last ten years. The proportion of financial resources allocated to salaries, research programs and capital investment over time can be used to predict research output trends. An imbalance in resource allocation may also reveal existing or emerging problems which affect research output.

According to Peterson et al. (1989), when the proportion of the research budget allocated to research programs falls below 40% of the overall recurrent budget, scientists may have limited resources to conduct meaningful research and remain productive.

Analysis of the data show that the proportion of financial resources allocated to salaries, research programs, and capital investment has followed an adequate allocation pattern. Excluding capital maintenance, the recurrent budget for public research programs in Jamaica has never fallen below 50% between 1983 and 1992. The analysis also shows that the allocation of resources to salaries has been consistent over the last ten years. The results from similar studies showed that resources allocated to research programs in Ecuador decreased from 34% in 1979 to 16% in 1983 and increased to 27% in 1986. These low percentage indicated that the program budget was far below the level considered to be adequate for a productive research system. The Mexico study also showed similar allocation patterns throughout the 1980s (Peterson et al., 1989),.
Objective 4: Resource Allocations to Agricultural Commodities and Export Values

This objective provided a means of comparing human and financial resources invested by the Jamaican public agricultural research system to domestic and export commodities. A common problem existing in many developing countries is the tendency to allocate a disproportionate amount of resources to traditional export crops; a policy initiated by colonial governments to supply raw materials to the European market. This export policy has been maintained by many independent governments to secure foreign exchange and revenues for investment in other sectors of the economy. An export strategy that ignores domestic crops results in a concentration of high resource farmers, neglects small farmers, and causes food shortages (World Bank, 1985).

According to Idachaba (1984), allocation of research resources to commodity programs should be based on the following objective: (a) importance of the commodity as a source of calories or protein, (b) contribution towards the balance of payments, either through export earnings or savings from import substitution, and (c) importance as a food staple of the poor. In general the closer a commodity comes to meet these criteria, the higher should be its research priority.

Analysis of the data indicated that resource allocation to traditional export crops (i.e., sugar, banana, coffee, citrus, cocoa) does not reflect the current policy of the public agricultural research system. Traditional export crop research is primarily conducted by the specific commodity boards operating in the country. In general, an
imbalance does not exist in the Jamaican public agricultural research system in the allocation of resources for export and domestic food crops.

According to the current policy of the Jamaican agricultural research system, particular focus is given to the development of appropriate technology for the production of domestic crops and for non-traditional export crops and livestock. Non-traditional export crops, including yams, mangoes and papaya, are grown for both export and domestic purposes.

**Objective 5: Access to Agricultural Technology from Research**

This objective examined the availability of agricultural technology from the Jamaican agricultural research system and the public extension system's capacity to access technology from research. The objective examined the nature and frequency of different types of interactions between research and extension personnel in Jamaica.

The need for strong research-extension linkages has received considerable attention in the literature. Coulter (1988) stated that the gap between research and extension may be due to institutional divisions with research and extension located in separate departments. Bridging the gap between research and extension has probably been the most serious institutional problem in developing an effective research-extension linkage. To be effective, the research system must generate technical recommendations and the two systems must develop linkages at both the institutional and personal level (Elz, 1984; World Bank, 1985). The most vital link
in the agricultural development process is the research-extension linkage (Raman, 1982). An effective feedback mechanism is one of the requirements to improve the linkage between research and extension. Lindt (1980) identifies weak research/extension linkages as one of the ten problems which most often contributes to the failure of extension activities.

Analysis of the data indicate that the nature and extent of contact between the public agricultural research and extension systems in Jamaica are limited and of an ad hoc basis. For example, the assistant research director maintains that a high level of interaction exist between the two systems, while the extension director believes that the interaction is limited, indicating how little the two system communicate.

In a similar study in Malawi, extension and research are aware of the importance of interacting, and several formal linkages at the national level have been established. However, at the lower levels, linkages depend more on word-of-mouth. Eight out of eleven types of contacts show strong research-extension linkages in Mexico. Research-extension linkage in Ecuador is very weak, where there are no formal mechanism for farmer feedback to research (Peterson et. al., 1988, 1989).

**Objective 6: Human Resources for the Public Agricultural Extension System in Jamaica**

This objective examined the level of education, training, and experience of the extension personnel (i.e., administrators/supervisors, subject matter specialists (SMSs), and field extension staff). The measures used were extension agent-to-
farmer ratio, percentage of SMSs among the professional field staff, and the educational level of extension professionals.

Human resources are central to the process of disseminating information to the farmer from the research system and for reporting farmer feedback to researchers. The success or failure of an extension system, depends in large part, upon having an adequate and quality extension staff. The need for sufficient human resources for extension is widely documented in the literature (Clark, 1987; Compton, 1989; UNDP, 1990; Saito & Weideman, 1990; Elz, 1984; World Bank, 1985; Peterson et al., 1988, 1989; Ruttan, 1987). SMSs play a critical role, as the success of an extension system in transferring technology, is directly influenced by the proportion and quality of SMSs (Swanson, 1990). Benor (1984) also asserts that SMSs are the prime trainers of extension agents and their immediate supervisors. Claar and Bentz (1984) note that the minimum percentage of qualified SMSs needed to service an extension system adequately is 12-13 percent. Claar and Bentz also recommend a Bachelor's degree as the minimum qualification for SMSs.

Analysis of the data indicate that the overall capacity of human resources for knowledge transfer in Jamaica is inadequate. Since 1992, there has been a large decline in personnel due to financial constraints, down-sizing, and reorganizing of the public extension systems. The ratio of agent-to-farmers is currently in excess of 1:1,000 since 1990. The average extension agent in Jamaica has 50% more farmers than the World Bank's (1981) recommended 800 farm households per agent ratio.
SMSs comprise 3% of the Jamaican field extension staff, which is dangerously low by any standard, the lowest of which is 12% (Claar & Bentz, 1984). The shortage of SMSs is considered a binding constraint, since the SMSs form a crucial link between research and extension, depriving the field staff of quick access to technical information and updated technology to solve the farmers' problem.

In a similar study in Malawi, two-thirds of the SMSs did not meet the minimum degree qualifications; only 4% of the extension staff in Malawi are SMSs and they perform both administrative and technical duties. The quality of education for SMSs in Ecuador is very low, with almost no post-graduate education represented within the extension system, and only 5% of the extension staff is SMSs, which is well below recommended levels (Peterson et. al., 1989).

**Objective 7: Examine Personnel Evaluation and Supervision for the Jamaican Public Extension System**

This objective examined personnel evaluation and supervisory practices used by the Jamaican public extension system, such as evaluation procedures, adequacy of supervision, and presence or absence of incentives and sanctions. The primary resource of an extension system is its trained personnel. Therefore, to develop a productive extension system requires good supervisory and administrative support. Administration must ensure that extension personnel are properly placed, have the necessary resources, and are supervised and rewarded for outstanding performance (UNDP, 1990).
A common problem associated with unstructured job assignments for extension personnel in the field is poor supervision. Where it is difficult to define the agent's assignments, it is equally difficult to establish criteria to evaluate their performances (World Bank, 1985). In India and Kenya the quality of extension supervision varies and supervision was reported to be weak in Thailand. Although most supervisors were conducting field visits, they did not appear to know what their supervisory job entailed or how to perform it effectively. The World Bank has promoted monitoring and evaluation functions as a means of ensuring effectiveness of extension services (World Bank, 1985). Extension staff should receive appropriate incentives to work well. Appropriate incentives are particularly important in extension, since the effectiveness of the system depends to a larger extent on the contribution of lower level staff. In addition, monitoring and evaluation is a management tool that can contribute significantly to effective extension (Benor, Harrison & Baxter, 1984). The importance of personnel evaluation and supervision to the success of the extension system has been widely discussed in the literature (Swanson & Peterson, 1989; Peterson et. al., 1980, 1989; Baxter, Slade & Howell, 1989; Elz, 1984; Swanson, 1990).

Analysis of the data indicate that the overall quality of performance evaluation and supervision is rated good but follow-up counselling and training are considered fair. Positive incentive criteria are not used to reward extension personnel. In general, the Jamaican Civil Service does not use positive incentive criteria; rather, promotion and pay increases are based on fixed salary scales and increments. The
consequences of the lack of positive incentives can lead to low morale and lack of motivation, enthusiasm and commitment (Benor, Harrison & Baxter, 1984). The responses from the interviews support this supposition as extension personnel complained that the lack of incentives has affected employee morale and low employee morale may in turn affect job performance.

Similar studies in Taiwan report that the quality of supervision and performance in the public extension system is good. For Malawi and Ecuador, the area of positive sanctions is weak and for negative sanctions, mechanisms to dismiss personnel for incompetence are weak. In Mexico, positive and negative sanctions as evaluation procedures are not applied (Peterson et. al., 1989).

Objective 8: Determine the Time Allocated by Jamaican Extension Officers to the Transfer of Agricultural Technology

This objective examines the amount of time Jamaican public extension officers devote to knowledge transfer activities. The role of an agricultural extension system is to provide technical advice to farmers to increase their productivity and incomes. To be able to serve effectively, their professional skills should be continually upgraded and not diluted with non-educational activities (Benor & Baxter, 1984).

Swanson and Peterson (1989) note that an extension system cannot be effective if extension personnel devote more of their time to non-educational duties. The responsibilities of the extension agent are simply too broad and vague (Benor, Harrison, and Baxter, 1984). Worldwide at least 140,000 persons years of extension staff time is allocated to these non-educational duties; non-educational activities are
counterproductive to extension's primary role (Swanson, 1990). The amount of time that extension personnel devote to technology transfer activities compared with other activities can serve as an indication of how effective an extension system is carrying out the knowledge transfer function (Peterson et al., 1988, 1989).

Analysis of the data indicates that educational activities performed by extension officers and agricultural assistants in Jamaica comprises on average 70% of their time. Time devoted to administrative activities would be considered moderate and time devoted to non-knowledge transfer activities is low (less than 13%). However, adequate time allocated to educational activities is a necessary, but not a sufficient condition for the successful transfer of technology. Responses from the interviews highlighted frustrations with the lack of adequate transportation, lack of clear mode of operation, and insufficient resources to conduct educational programs.

Similar studies in Mexico show that non-educational activities consumed more time than educational activities for the extension personnel. Moderate amounts of time were spent on knowledge transfer activities and low percentages on non-knowledge transfer activities in Ecuador. In Malawi, extension agents spend 80% of their time on knowledge transfer and related activities and 20% on non-knowledge transfer activities. In Taiwan, 44% of the work carried out by extension personnel of the District Agricultural Improvement stations is devoted to educational activities (Peterson et al., 1989). Extension agents in several areas of Botswana devote
between 38 and 61% of their time annually to non-educational activities (Forstman, 1984 cited in Peterson et. al., 1989).

**Objective 9: Allocation of Financial Resources to Extension Salaries, Programs and Capital Investment**

This objective examined the proportion of the extension budget allocated to extension salaries, programs, and capital maintenance in the Jamaica public agricultural extension system between 1983 and 1992. The proportion of financial resources allocated to salaries, programs, and capital investment may provide evidence of resource constraints in the extension systems. According to Swanson and Peterson (1989), specific percentages have not been established, but allocations of less than 30% of the total budget to extension programs will result in poor performance of the system. Allocation of 35-40% to programs and operational costs would give extension personnel adequate resources for travelling, publications, teaching aids and supplies needed to operate effectively (Swanson, 1990). According to Blanckburg (1984), low staff salaries is a major reason for "brain drain" in many extension systems.

In Jamaica, financial allocations to extension programs have averaged 26% since the reorganization of the Jamaican extension system in 1990. This percentage is below the recommended 35-40% needed for an effective extension system (Swanson, 1990; Peterson et. al., 1989). The low allocation to the program budget over the last ten years could be due to an increase in salaries.
Similar studies in Ecuador show that salaries accounted for over 80% of the extension budget and programs and capital investment accounted for 12% and 4%, respectively. With such a low allocation to extension programs only limited extension work can be done in terms of transmitting new information to farmers.

**Objective 10: Types of Technology Transfer Activities Used by Jamaican Extension Officers**

This objective examined the type of activities used by the Jamaican public agricultural extension system to transfer technology to farmers. The methods most commonly used are individual contacts, group meetings, and mass media. Assessing dissemination activities within the extension system is necessary to determine the overall capacity of the system to inform farmers about available technology. The objective gives the percentage of farmers visited by field extension personnel, the average number of group farmer contacts initiated by extension, the average number of demonstrations complete annually per field agent, the percentage of farmers with direct extension contact, the media sources use by extension, and the percentage of farmers with radio contact and access to agricultural programming.

The percentage of farmers visited by extension personnel helps to assess the degree of contact and the probability that technology transfer has taken place. Similarly, the more group contacts, field demonstrations, and media sources used, the greater the likelihood that technology will be transferred to the farmers (Swanson & Peterson, 1989; Peterson *et. al.*, 1988, 1989). Benor & Baxter (1984) identify individual contact as a key feature of the training and visit systems of agricultural
extension. Blackenburg (1984) describes how mass media (combination of visual aids with written and spoken words) reached many farmers at low costs with easily understandable information. Group activities reach a large audience and when operated well are extremely effective. Blackenburg (1984) identified individual farm visits and demonstrations as the most important extension methods used in East Africa.

Analysis of the data indicates that the percentage of farmers visited annually by the field staff is extremely low. Twenty-six percent of farmers served by the public extension system received on-farm visits. Individual farm visits can establish credibility and more readily identify agricultural needs of farmers.

Similar studies indicate that in Malawi, 11% of farmers received on-farm visits. Mexico and Ecuador do not include on-farm visits as a major dissemination technique because it is not cost efficient. Mexico emphasized the group method technique of technology dissemination. Ekpere (1974), cited in Peterson et. al. (1989), stated that 25% of Nigerian extension staff made more than 100 farm visits annually which was considered very high. Another 45% made between 49-100 visits, which is considered a moderate effort. The remaining 30% made fewer than 48 visits, which is judged to be low.

Analysis of the data also shows that the Jamaican public agricultural extension system relies almost exclusively on group contact (field days, demonstrations) as a means of technology dissemination. Each field agent holds approximately eight group activities per year with an average of 27 farmers in attendance. Thus, each
year field agents hold 1,078 group activities, and approximately 16% of farmers are reached through group activities. Guidelines for this measure are lacking, but a low incidence of group contact may indicate an inefficient dissemination strategy. Group activities are an appropriate extension strategy to disseminate new information to small-scale Jamaican farmers. They usually have a low level of education and may learn more readily by hearing and observing. In addition, the group approach is emphasized because it is cost effective in Jamaica, and has the potential to reach more farmers. Also, field agents have limited resources (i.e., transportation, teaching aids) and they have to deal with a large number of farmers.

Similar studies indicate that 20% of the farmers in Malawi participate in group meetings, the most common extension method used by field agents. In Taiwan, approximately 20% of the farmers participate in group meetings annually. Each field agent holds approximately one group meeting per day. In Mexico, the average field agent initiates 140 group meetings per year.

Analysis of the data shows that the average number of demonstrations completed annually per agent is three. In Mexico, four demonstrations per agent per year was considered a significant achievement (Swanson & Peterson, 1989). The number of farmers attending field demonstrations in 1991-1992 was 2% of the farm population served by the public extension system. This percentage seems low and suggests that farmers are not well informed of demonstration activities, not interested, or need incentives to attend. Guidelines are lacking, but 10% of the farmers would be considered a reasonable target (Swanson & Peterson, 1989). In
Malawi, the amount of field demonstrations conducted varies, however the range is 2-14 per field agent annually, with 5% of farmers attending (Swanson & Peterson, 1989). The assumption is that the more field demonstrations held, the greater the likelihood that technology will be transferred to farmers.

Analysis of the data shows that the percentage of farmers with direct extension contact in Jamaica is 42% primarily through field days and demonstrations. Guidelines for the appropriate range of direct contact have not been established, but highly successful extension systems have direct contact of over 50% (Swanson & Peterson, 1989). With 42% of farmers reached by direct extension contact, and the close proximity of each farmer growing similar crops, it is highly possible that those farmers without direct extension contact will receive new information by word-of-mouth through other farmers.

Similar studies indicate that 20% of all farmers in Malawi are contacted directly by one or more extension methods. The extension system in Ecuador has direct contact with 10% of its farmers primarily through organized groups. Taiwan has direct contact with over 90% of farm households primarily through township farmer associations (Peterson et. al., 1989).

The amount of media output produced by the Jamaican public extension system annually was not available. However, eight different types of media output are used by the public extension system in Jamaica to disseminate technology to farmers. Flip charts and teaching aids were ranked as the most important type of media used by the public extension system. Flip charts are appropriate sources of
media exchange to the public extension system because they are inexpensive and appropriate for group situations. Leaflets and fact sheets are also appropriate because they are cost efficient for the public extension system and provide an excellent source of new information. Exhibits and agricultural shows are very important to the public extension system because they can provide simple demonstration techniques and serve as an excellent source of new information. Extension posters, signs, and billboards are appropriate and provide for an excellent source of technology transfer. Bulletin boards are strategically placed at extension area offices to catch the farmers' attention. Bulletins may not be appropriate as a source of information for most farmers; many bulletins are of a technical nature and go beyond the scope of most farmers.

Guidelines for these measures are lacking, but the general assumption is that the more media output extension produces the greater the potential for technology transfer. Jamaica is a closely knit country with easy access to new information. Therefore, the amount of media output currently used by extension is acceptable to transfer new information to farmers.

Similar studies indicate that Malawi extension service produces six extension publications in one year. Mexico produces 12 new extension publications in one year but this amount may be inadequate due to the size of the country and the diversity of its agriculture. Mexico offers three agricultural exhibits per year while Malawi produces 100 (Peterson et. al., 1989).
Analysis of the data shows that in Jamaica 35% of farmers have contact with radio programming. Technical radio programs and TV programs are expensive to produce and are not frequently used by the Jamaican public extension system. Guidelines for this measure are lacking, but a low percentage of farm households with radio contact suggests that the use of radio as a channel of communication to farmers is of less importance. The public agricultural extension system in Jamaica does not produce agricultural radio programs directly. Agricultural radio programs are produced by the Jamaica Information Service (JIS); however, the JIS programs include information from the public extension system.

Similar studies in Nigeria show that the number of farm households obtaining agricultural information from radio varies by region, but the range is 9.5% to 65% (Peterson et al., 1989). In Malawi, only 18% of farm households own a radio. Mexico broadcasts 730 radio and television agricultural programs annually, and Malawi produces over 750 agricultural programs for the radio. Ecuador produces no radio or television programs with agricultural information through government agencies; agricultural inputs are advertised by private agencies (Peterson et al., 1989).

Conclusions of the Study

Based upon the findings of the study and comparison with similar studies, the following conclusions are offered:
1. The Jamaican public agricultural research system lacks direct access to external sources of knowledge and technology. The public research system is not effective in providing financial support for its researchers to participate in international research conferences. Researchers do not have ample opportunity to interact with international researchers in their areas of expertise or to facilitate the sharing of information. Interaction with international research is inadequate to maintain a viable public research system.

2. The Jamaican public agricultural research system does not invest sufficiently in human resources for research activities. The system lacks a sufficient number of trained research personnel to adequately conduct an effective research program. The number of research staff with advanced degrees is inadequate relative to researchers with Bachelor's degrees. The research system relies exclusively on researchers with Bachelor's degrees for a significant amount of research activities. The research system fails to attract and retain highly qualified research scientists. The research system does not provide adequate support in terms of technicians for researchers to conduct adequate research.

3. The Jamaican public agricultural research system allocates an adequate proportion of financial resources to salaries, programs, and capital
investments. However, the research system fails to attract and retain highly qualified research scientists and research output is low.

4. The Jamaican public agricultural research system allocates resources to commodity research programs that serve both non-traditional exports and domestic purposes. However, adequate resources are not invested in local food crop research to increase productivity, even though local food crops produced by small-scale farmers are consumed on a larger scale. There is a shortage of adaptive research for domestic commodities and research focussing on small landholders' agriculture.

5. The research-extension link in the Jamaican public agricultural technology system is not sufficient to ensure and maintain an adequate level of interaction between research and extension personnel. There are no clear policies for establishing a research-extension linkage, primarily due to the lack of a strong bond at the administrative levels. Research and extension do not work together at the initiation stage of technology development which makes it more difficult to expect linkage at the critical points of the technology transfer process. Both systems are plagued with a tradition of isolation and territorial problems.

6. The overall capacity of human resources in the Jamaican public agricultural extension system is inadequate and lacks quality. The
number of SMSs, who form the crucial link between research and extension, is dangerously low. The ratio of agent-to-farmers is excessively high. The system lacks a sufficient number of trained extension personnel at the field level. Frequent in-service training and updated information is lacking.

7. The Jamaican public agricultural extension system follows various aspects of recommended supervisory and evaluation procedures. However, the system does not use positive incentive criteria to reward extension personnel. Promotion and salary increases are based on fixed salaries and increments. Reward for performance and extra pay for additional training is weak. Follow-up counseling and training is on a limited basis.

8. The Jamaican public agricultural extension system devotes more time to educational duties in comparison to non-educational duties. The extension system has adequate time to conduct educational activities for the transfer of new technology.

9. The Jamaican public agricultural extension system does not allocate adequate financial resources to the recurrent extension budget. The extension system is constrained by lack of adequate resources to educate farmers, lack of orientation of new staff, and inadequate in-service training programs. The proportion of financial resources allocated to salaries exceeds the recurrent program budget.
10. The Jamaican public agricultural extension system uses a variety of dissemination techniques to transfer new and improved agricultural technology to farmers. The techniques used are appropriate to inform farmers about available technology. Individual contacts are limited due to lack of transportation. The extension system relies excessively on group contacts.

Implications and Recommendations

The following implications and recommendations are based upon the conclusions of the study.

1. Low access to external sources of knowledge is viewed as a major constraint to the development and adoption of agricultural technology, particularly for small farmers who make up approximately 80% of the farming population in Jamaica. Low access deprives the research system of the opportunity to screen superior genetic materials which could then be adopted to local conditions. To increase the level of access to external knowledge and technology, the public agricultural research system should establish stronger linkages with IARCs through training and consultations pertaining to domestic crops. The research system should provide an adequate allocation of financial resources to allow selected researchers to participate in international conferences,
seminars, and training courses. In addition, researchers should have greater contact with international researchers through in-country conferences. A closer working relationship with the in-country commodity boards should be encouraged since they have stronger linkages with international institutions. Closer relationships with the University of the West Indies should be developed, since the University constitutes an international community of agricultural research personnel.

2. Inadequate investment in human resources is viewed as a severe constraint to the development of agricultural technology. If the Jamaican public agricultural research system continues to have low investment in human resources, this may lead to failure to adopt research programs and to conduct effective research. If the research system lacks a quality research staff to carry out its own research, it will also lack the capabilities to adopt research done elsewhere. Lack of adequate capacity slows down the research process, because highly trained researchers are involved in less scientific activities thus, are unable to maximize their potential. To improve the adequacy and quality of human resources, the public agricultural research system should establish contact with graduate departments of foreign institutions to identify Jamaican students of agriculture and related subjects. A program to compensate these students pending their return
to Jamaica should be developed. Whenever possible, research in support of dissertation subjects should be undertaken in Jamaica on a problem of direct relevance to the country. Assistance should be provided to secure research personnel through bilateral technical assistance programs from other countries to alleviate the shortage of qualified researchers in the short run. Procedures to significantly expand and improve training programs needed to meet research requirements should be devised.

3. **Adequate allocation of financial resources to the recurrent program budget is viewed as a favorable investment to increased research output.** Adequate allocations will provide researchers with adequate resources to undertake meaningful research programs such as fertilizer and variety trials, screening of genetic technology, disease control, training programs, research seminars, and research publications. In addition, adequate allocation will prevent severe disruptions in on-going research activities and may contribute to attract and retain qualified research staff.
4. Inadequate planning, allocating, and monitoring resources allocated to domestic crop research is detrimental to agricultural productivity in Jamaica. If the Jamaican public agricultural research system continues to have inadequate provisions to domestic commodities, this could lead to a concentration of large farmers, small farmers migrating to the urban areas and possibly creating social problems and inefficient use of land leading to higher food prices, and neglect of small landholders. To improve the provision of resources to domestic crops, the research system should establish an overall research program that reflects priorities for domestic commodities and small-scale farmers.

5. Inadequate linkages between research and extension is viewed as a major impediment to agricultural development. Without strong linkages, new technology will not flow frequently from the research system to farmers and from the farmer to the research system. If the Jamaican public agricultural research and extension systems continue to have weak linkages, the time-lag that exists between the availability of new technology and its application to the farming community will become even greater. The process of information transfer to farmers will not only be slowed down but the greater impact is that researcher will continue to develop agricultural technology that is irrelevant to farmers’ needs. If weak linkages at the administrative levels continue, information shared at the top level will not filter through the system,
there will be no direct route for the research system to provide research findings to farmers, and extension credibility with the farmers will be decreased. To improve the linkages between the Jamaican public agricultural research and extension systems, there should be greater interaction at the administrative levels to discuss farmers' problems and recommendations. There should be regular training sessions and workshops for extension and research personnel, joint review of research publications, joint participation in planning adaptive and applied research activities, shared responsibility for farm trials, greater participation of farmers, joint field trips to examine specific farm problems, frequent visits of extension staff to research stations, and joint field days and demonstration activities.

6. Inadequate capacity and quality of human resources is viewed as a serious limitation to the effectiveness of the extension system. If the Jamaican agricultural extension system continues to operate with an inadequate number of well-trained and well-supported field agents, the system will become more handicapped in its ability to plan and execute sound education programs. The lack of skilled extension personnel often prevents the educational tasks which are the substance of extension (World Bank, 1985). Inadequate capacity leads to lower levels of contact or coverage between field agents and farmers as well as increased allowances for extra coverage. To increase the capacity
and quality of extension personnel, the Jamaican public agricultural extension system should implement programs to increase the provisions for students to study outside the country and provide their employment upon return should also be considered. Expanding and strengthening the existing training programs to improve the knowledge and skills necessary for each area of assignments is needed. Increasing and upgrading the technical staff and middle-level managers up to Master's degree levels is also needed.

7. Lack of an adequate reward system is viewed as a major administrative problem and can impede extension performance. If the Jamaican public extension system continues to ignore recognition of good performance and application of positive incentives criteria, this could lead to further inefficient staff performance which can have a negative effect on the delivery of technology to farmers. Moreover, lack of incentives is considered detrimental to good extension work, and leads to poor job performance, obstacles to staff motivation, and a distraction to better trained employees (Benor, Harrison & Baxter, 1984). To improve the adequacy of the reward system the Jamaican public agricultural extension system should provide material and intangible encouragement for extension personnel at all levels. The material encouragement could include salary increases, promotions, opportunities for training, transportation, and compensation that are
equal with those of staff with similar functions and responsibilities. The intangible support could include adequate professional and social recognition for good work. In addition, work assignments should be purposeful and satisfying.

8. More time devoted to educational activities is an essential requirement to an effective extension system. Time devoted to non-educational activities could compromise the system's primary goals of knowledge transfer. If the Jamaican public extension system continues to devote more time to educational activities they will not only contribute to farmer-agent credibility, less complicated work load, adequate supervision, and prioritized assignments, but also contribute to increased agricultural productivity.

9. Inadequate allocation to the recurrent extension program budget is a severe constraint to the process of agricultural development. If the Jamaican public agricultural extension system continues to allocate low levels of financial resources to the extension program budget, the delivery of technology and new information to farmers will be further diminished. Further reduction in the program budget could lead to lack of transportation, travel expenses, teaching aids, and demonstration equipment needed to operate an effective educational and technology dissemination program. To improve the adequacy of allocation to the recurrent budget, the Jamaican public agricultural extension
system should adjust the budget through the addition of more financial resources. Maintaining a workable balance between salary, program, and capital so that adjustments can be made if the overall extension budget decline is a necessary administrative responsibility.

10. A variety of dissemination techniques is essential to the successful transfer of agricultural technology and new information to the farming community. If the Jamaican public agricultural extension system continues to use a combination of different techniques, the greater will be the possibility of technology transfer to farmers. A combined approach usually results in a more effective extension strategy, because the more often a message is repeated in various forms, the more likely it will be remembered (Blankenberg, 1984).

Strengthening the research-extension link so that researchers are aware of the needs of farmers and thus develop the appropriate technology, and training sufficient SMSs are the two most critical elements that the Jamaican Public Research-Extension systems must address. These two problems must be dealt with before any of the other recommendations will improve the research-extension systems in Jamaica.
Need for Further Study

Based on the findings, conclusions, implications, and recommendations of the study, the following studies are recommended for further study:

1. A similar study should be conducted on the policy subsystem to determine the Jamaican government's commitment to agriculture as compared to other areas of national concern, such as education and health. The availability and use of agricultural credit to purchase new technology (e.g., hybrid seed, pesticides, fertilizers, crop rotations) and provision of reliable markets where farmers can sell their produce are examples of factors critical to the transfer process that are affected by governmental policies. Even though technology development and knowledge transfer systems may be in place, government policies will influence how and what technology is developed and the methods used to transfer technology to farmers.

2. Studies on the technology utilization subsystem are needed to determine whether the farmers served by the Jamaican public agricultural research and extension systems have reasonable access to new technology, the percentage of farmers using specific types of technology, and the effect of new and improved technology on national production. The constraints or barriers to the adoption of new technologies by targeted clientele need to be identified. The ultimate
goal of the public agricultural research and extension systems is the utilization of new and improved technology by farmers, which is the key to increased productivity and profitability.

3. Similar studies, reflecting public agricultural technology systems, should be conducted throughout the Caribbean region. Most of the countries in the Caribbean have similar agricultural technology systems. Highlighting the strengths and weaknesses of the technology systems will determine similarities in the region or an indication of regional problems. This analysis could encourage governmental policy makers to address concerns from a broader perspective by using expertise throughout the region.

4. Future studies are needed to determine the flow of new and improved technologies, from the time they are developed and enter the system, until they reach the farmers. This analysis could evaluate the functional linkages that facilitate or restrict the flow of specific technologies to farmers. Tracking the flow of technology will identify where time lags are occurring and institutional constraints that may be slowing down or blocking the flow of new technology. From such an assessment the government can initiate policies to improve the performance of the overall system to increase agricultural productivity and profitability.
APPENDIX A
ANALYTICAL FRAMEWORK
Appendix Figure 1. Functional Model of National Agricultural Technology System Showing Internal Components and External Factors.
APPENDIX B
PANEL OF EXPERTS
# Panel of Experts

<table>
<thead>
<tr>
<th>Panel Member</th>
<th>Position</th>
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<tr>
<td>Dr. Janet L. Henderson</td>
<td>Associate Professor</td>
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<td></td>
<td>Department of Agricultural Education</td>
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<td></td>
<td>The Ohio State University</td>
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<tr>
<td>Dr. Joseph S. Ottobre</td>
<td>Associate Professor</td>
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<tr>
<td></td>
<td>Department of Dairy Science</td>
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<td></td>
<td>The Ohio State University</td>
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<tr>
<td>Mr. Irvin</td>
<td>Deputy Executive</td>
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<td></td>
<td>Extension Service</td>
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<td></td>
<td>Jamaica</td>
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<td>Mr. L. Henry</td>
<td>Extension Administrator</td>
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<td></td>
<td>Ministry of Agriculture</td>
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<tr>
<td></td>
<td>Jamaica</td>
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<tr>
<td>Ms. F. Chambers</td>
<td>Extension Officer</td>
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<tr>
<td></td>
<td>Ministry of Agriculture</td>
</tr>
<tr>
<td></td>
<td>Jamaica</td>
</tr>
<tr>
<td>Dr. Garee W. Earnest</td>
<td>Department of Agricultural Education</td>
</tr>
<tr>
<td></td>
<td>The Ohio State University</td>
</tr>
</tbody>
</table>
1. What is your name? _________________________________

2. What is your age? ______________________

3. What is your highest level of education? ____________________

4. What is your professional experience? ____________________

5. What is your current job title? _________________________

6. What is your area of expertise? ________________________

7. In what parish do your work? __________________________

8. What is your address and telephone number? ______________

9. Could you please tell us about your current focus of work? _________
Researchers/Research Administrators

Technology Development Indicators

1. **Access to External Knowledge and Technology**

   (a) What type and extent of interaction do you have with researchers and research activities outside of Jamaica?

2. **Human Resources for Agricultural Research**

   (a) Do you have enough technical support (i.e., technicians, up-to-date equipment, space/facilities) to conduct your research program? Please explain.
(b) Do you feel that there are enough personnel for agricultural research in Jamaica? Please explain.

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(c) Do you feel that the qualifications and experience of current personnel are appropriate for agricultural research in Jamaica? Please explain.

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3. **Resource Allocation to Salaries and Programs**

   (a) Do you feel that the balance between personnel and operating budgets is appropriate? Please explain.

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4. **Resource Allocation to Commodities in Research**

   (a) Do you feel there is an adequate balance between resources invested for research in agricultural commodities for exportation and agricultural commodities for domestic consumption? Please explain.

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Additional Questions

(1) What role do you play in the transfer of technology?

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(2) How do you decide your research agenda?

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(3) What type and extent of interaction do you have with:

(a) Extension Agents/Personnel

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________________________________________________________________________
(b) Farmers

(4) What do you propose as the ideal technology transfer model? (Provide an example of a new technology related to the researcher's program.)
(5) How do you perceive the linkages between researchers and agricultural extension agents in Jamaica? What recommendations do you have for improving the linkages between research and extension?
1. What is your name? _______________________________

2. What is your age? __________________

3. What is your highest level of education? ______________

4. What is your professional experience? _____________________________
   ___________________________________________________
   ___________________________________________________

5. What is your current job title? _______________________________

6. What is your area of expertise? _______________________________

7. In what parish do your work? _______________________________

8. What is your address and telephone number? _______________________
   ___________________________________________________
   ___________________________________________________

9. Could you please tell us about your current focus of work? _________
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Extension Agents/Administrators

Technology Transfer Indicators

1. Personnel Administration and Supervision

(a) Do you feel that the supervision and evaluation procedures for the extension service are adequate and fair? Please explain.

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(b) Do you feel that your salary and benefits are comparable to professionals with the same educational background in other public or private institutions? Please explain.

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2. **Availability and Access to Technology**

   (a) What type and extent of interaction do you have with agricultural scientists and subject matter specialists?

3. **Time Allocated to Technology Transfer**

   (a) Do you feel that you have adequate time to perform educational activities for farmers, as compared to non-educational activities (e.g., debt collection, census data). Please explain.
4. **Resources Allocation Between Extension Salaries and Programs**

(a) Do you feel that the balance between personnel and operating budgets is appropriate? Please explain.

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5. **Technology Dissemination**

(a) What type of activities do you use to transfer technical information to farmers? Do you feel the activities are adequate? Please explain.

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6. Personnel Resources for Knowledge Transfer

(a) Do you feel that extension agents are qualified to perform their responsibilities based on their educational training? Please explain.

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**Additional Questions**

(1) What role do you play in the transfer of new technology in Jamaica? (Provide an example of a new technology related to the agent’s program and then ask the agent to draw a picture of the transfer process.)

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(2) What do you propose as the ideal technology transfer model? (Ask the agents what changes they would make in their drawing.)

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____________________________________________________________________
(3) Looking at the drawing, how do you perceive the linkages between researchers and agricultural extension agents in Jamaica? What recommendations do you have for improving the linkages between research and extension in Jamaica?
APPENDIX D
SET OF INDICATORS
Appendix Table 1

The Public Agricultural Research System Access to External Sources of Knowledge and Technology

<table>
<thead>
<tr>
<th>Access To:</th>
<th>Commodity A</th>
<th>Commodity B</th>
<th>Commodity C</th>
<th>Commodity D</th>
<th>Commodity E</th>
<th>Commodity F</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Legumes</td>
<td>Root Crops</td>
<td>Cereal Grains</td>
<td>Papaya</td>
<td>Beef</td>
<td>Dairy</td>
</tr>
</tbody>
</table>

**Level of Access**

**Genetic Technology**

**International Agricultural Research Center**

Regular IARC Consultations

**Total External Access Rating**

**Average External Access Rating**

*Note: Access ratings were based on the following scale: 0 = No Access; 1 = Low Access; 2 = Medium Access; 3 = High Access.*

*Source: Personal interviews with the Deputy Director of the Research and Development Division in the Jamaican Ministry of Agriculture and the Principal Researcher for Livestock at Bodles Research Station.*
Appendix Table 2

Number and Percentage of Scientific Personnel at Different Levels of Training (1986-1992)

<table>
<thead>
<tr>
<th>Year</th>
<th>Ph.D.</th>
<th>Masters</th>
<th>B.Sc.</th>
<th>Diploma or Certificate Holder</th>
<th>Total</th>
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<tr>
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<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
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<td>1986</td>
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Appendix Table 3

Technician Support Provided for Scientists and Technicians (1992)

<table>
<thead>
<tr>
<th>Categories</th>
<th>N</th>
<th>%</th>
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<tbody>
<tr>
<td>Senior Scientists (Ph.D.)</td>
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<tr>
<td>Junior Scientists (M.S.)</td>
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<tr>
<td>Professional Agricultural Researchers (B.Sc.)</td>
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<tr>
<td>Research Technicians (Diploma/Certifical Level)</td>
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<tr>
<td>Total Research Personnel</td>
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</table>

Ratio = Number of Technicians/Total Research Personnel

Appendix Table 4

Budget Allocations to Research Salaries, Programs, and Capital (in $000)

<table>
<thead>
<tr>
<th>Year</th>
<th>Salaries</th>
<th>%</th>
<th>Programs Recurrent</th>
<th>%</th>
<th>Capital</th>
<th>%</th>
<th>Total</th>
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10-Year Average

Appendix Table 5

Annual Research Allocations Excluding Capital Expenditures

<table>
<thead>
<tr>
<th>Year</th>
<th>Salaries</th>
<th>%</th>
<th>Programs</th>
<th>%</th>
<th>Total</th>
<th>% Change</th>
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<td></td>
</tr>
<tr>
<td>1992</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Appendix Table 6

Resource Allocations to Agricultural Commodities and Export Values (In $000)

<table>
<thead>
<tr>
<th>Commodity</th>
<th>Export Value</th>
<th>Ministry of Agriculture Research</th>
<th>Ministry of Agriculture Research</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>%</td>
<td>Staff Allocated to Commodity</td>
</tr>
<tr>
<td>Sugar</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Banana</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coffee</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pimento</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Citrus</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cocoa</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yams</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pumpkins</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mangoes</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Appendix Table 7

Access to Technology from Research (n = 6)

<table>
<thead>
<tr>
<th>Type of Research - Extension Contact</th>
<th>Contact Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visits to research stations by extension personnel</td>
<td></td>
</tr>
<tr>
<td>On-farm trials/demonstrations conducted jointly by research and extension</td>
<td></td>
</tr>
<tr>
<td>Technical and related publications from research to extension</td>
<td></td>
</tr>
<tr>
<td>Training sessions or workshops on new technology</td>
<td></td>
</tr>
<tr>
<td>Joint research-extension meetings on technical recommendations and to plan and review joint activities</td>
<td></td>
</tr>
<tr>
<td><strong>Total Index Score</strong></td>
<td></td>
</tr>
</tbody>
</table>

**Note:** 0 = No Contact; 1 = Low Level Contact; 2 = Moderate Contact; and 3 = High Level Contact.

### Appendix Table 8

**Interaction Between Research and Extension Personnel (n = 2)**

<table>
<thead>
<tr>
<th>Types of Interaction</th>
<th>No</th>
<th>Yes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annual meeting to discuss recommendations</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Annual meeting to discuss farmers' problems for which answers are not known</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Researchers who participate in extension training programs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Research and extension personnel collaborating on field trials and demonstrations</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Field days at research centers for extension personnel</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Technical publications issued by research or extension with review or collaboration</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Note**: 1 = Extension Director, 2 = Assistant Research Director

**Source**: Interviews with the Extension Director (RADA) and the Assistant Director of Research and Development (R & D), Ministry of Agriculture, Hope Gardens, Kingston, Jamaica.
Appendix Table 9

Formal Contacts Between Research and Extension for Purposes of Feedback (n = 2)

<table>
<thead>
<tr>
<th>Types of Formal Contact</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meetings between administrative personne</td>
<td></td>
</tr>
<tr>
<td>Meetings between technical personnel</td>
<td></td>
</tr>
<tr>
<td>Joint on-farm trials demonstrations</td>
<td></td>
</tr>
<tr>
<td>Workshops-training sessions directly involving research personnel</td>
<td></td>
</tr>
</tbody>
</table>

Source: Interviews with the Extension Director (RADA) and the Assistant Director of Research and Development (R & D), Ministry of Agriculture, Hope Gardens, Kingston, Jamaica.
Appendix Table 10

Extension Agent-to-Farmer Ratio (1992)

<table>
<thead>
<tr>
<th>Number of Field Agents</th>
<th>Number of Farmers</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Appendix Table II

Percentage of Subject Matter Specialists Among the Professional Field Staff

<table>
<thead>
<tr>
<th>Year</th>
<th>SMS</th>
<th>Professional Field Staff</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>1988</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1989</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>1990</td>
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<td></td>
<td></td>
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<td>1991</td>
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<td></td>
</tr>
<tr>
<td>1992</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1993***</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* denotes regional level, ** denotes national level, *** projected for FY 1993.

### Educational Levels of Extension Personnel

<table>
<thead>
<tr>
<th>Year</th>
<th>Postgraduate</th>
<th>B.Sc. Degree or Equivalent</th>
<th>Associate of Science Degree - 3 Years (ASD)</th>
<th>Two-Year Diploma</th>
<th>Two Year Certificate</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1983</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1984</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1985</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1986</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>1987</td>
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<td></td>
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<td>1988</td>
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<td>1989</td>
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<td>1990</td>
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<td>1991</td>
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<td></td>
<td></td>
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</table>

Appendix Table 13

Personnel Management Procedures Used in the Extension System (n = 7)

<table>
<thead>
<tr>
<th>Item</th>
<th>No</th>
<th>Yes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Evaluation Procedures</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Are there written and distributed evaluation procedures and criteria?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Is there an annual written evaluation on each staff member?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do different supervisory levels have input into the evaluation?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Are field assistants notified of evaluation results?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do evaluation procedures involve follow-up counseling or training when needed?</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Supervision</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Is there a reasonable ratio of supervisors to field staff?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Are supervisors instructed to observe performance and provide counseling?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do supervisors prepare written evaluations and discuss them with employees?</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Positive Incentive Criteria</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Is pay distributed on a merit basis?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Does a considerable range in salary exist based solely on performance?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Does extra training result in higher pay for the same job?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Are promotions based on performance</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Are supervisors encouraged to recognize and commend excellent work on the job?</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Negative Sanction Criteria</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Does the system provide informal feedback on poor performance?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Does the system provide for written reprimands?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Does the system provide for punishment such as loss of pay or demotion?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Does the system dismiss employees for incompetence that cannot be corrected?</td>
<td></td>
<td></td>
</tr>
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</table>

Appendix Table 14

Time Allocated to Technology Transfer

Duties and Responsibilities of Extension Field Personnel

<table>
<thead>
<tr>
<th>Duties and Responsibilities</th>
<th>% of Time Spent</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>E.O.</td>
<td>A.A.</td>
</tr>
</tbody>
</table>

**Non-knowledge Transfer Activities**

Regulator Work (monitoring compliance with government directives and regulations)

Data Collection (census, crop forecasting, etc.)

Work on Other Government Programs (credit, subsidies, etc.)

Servicing Local Government (settling disputes, etc.)

**Knowledge Transfer Activities**

Planning and Conducting On-Farm Visits

Planning and Conducting Educational Meetings, Field Days and Other Group Activities

Other Educational Activities (e.g., mass media)

**Planning and Support Activities**

Preparing Administrative Reports

Attending In-Service Training

Other Support Activities

Appendix Table 15

Budget Allocations to Extension Salaries, Operations, and Capital (1992)

<table>
<thead>
<tr>
<th>Year</th>
<th>Salaries</th>
<th>%</th>
<th>Operations</th>
<th>%</th>
<th>Capital</th>
<th>%</th>
<th>Total Budget</th>
</tr>
</thead>
<tbody>
<tr>
<td>1982</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1983</td>
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<td>1984</td>
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<tr>
<td>1987</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1988</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1989</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>1990</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>1991</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1992</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Appendix Table 16

Percentage of Farmers Visited by Field Extension Personnel (1992)

<table>
<thead>
<tr>
<th>A. Average No. of Farm Visits per Agent</th>
<th>B. No. of Field Agents</th>
<th>C. Total No. of Farmers</th>
</tr>
</thead>
</table>

Total Number of Farm Visits = \( A \times B = N \)

\% of Farmers Visited = \( N + C \)

Appendix Table 17

Average Number of Group Farmer Contacts Initiated by Extension (1992)

<table>
<thead>
<tr>
<th>Type of Group Activity</th>
<th>Actual Number in 1992</th>
</tr>
</thead>
<tbody>
<tr>
<td>Field Days</td>
<td></td>
</tr>
<tr>
<td>Demonstrations</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td></td>
</tr>
</tbody>
</table>

Appendix Table 18

Average Number of Demonstrations Completed Annually Per Field Agent (1992)

<table>
<thead>
<tr>
<th>A. Total No. of Demonstrations =</th>
<th>B. Total No. of Field Agents =</th>
</tr>
</thead>
<tbody>
<tr>
<td>A divided by B = Average No. of Demonstrations per Agent, or</td>
<td></td>
</tr>
<tr>
<td>A. Total No. of Farmers =</td>
<td>B. No. of Farmers Attending Demonstrations =</td>
</tr>
<tr>
<td>B divided by A = % of Farmers Attending Demonstrations, or</td>
<td></td>
</tr>
</tbody>
</table>

Appendix Table 19

Percentage of Farmers with Direct Extension Contact (1992)

A. Estimates of Farmers Contacted (all forms of individual and group contact) =

B. Total Number of Farmers in Country =

A divided by B = % of Farmers Contacted, or %

Appendix Table 20

Rank Order of Media Sources Used by Extension (1992)

<table>
<thead>
<tr>
<th>Type of Media</th>
<th>Rank Order</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flip Charts/Teaching Aids</td>
<td></td>
</tr>
<tr>
<td>Leaflets/Fact Sheets</td>
<td></td>
</tr>
<tr>
<td>Exhibits, Ag Shows, &amp; Fairs</td>
<td></td>
</tr>
<tr>
<td>Extension Posters/Signs/Bill Boards</td>
<td></td>
</tr>
<tr>
<td>Bulletins</td>
<td></td>
</tr>
<tr>
<td>Weekly Newspaper Articles</td>
<td></td>
</tr>
<tr>
<td>Technical Radio Programs</td>
<td></td>
</tr>
<tr>
<td>Movies/VCR/TV Programs</td>
<td></td>
</tr>
</tbody>
</table>

## Appendix Table 21

### Percentage of Farmers with Radio Contact and Programming (1992)

<table>
<thead>
<tr>
<th>A. Listening Population</th>
<th>B. Total Population</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Percentage of Total Population = \( \frac{A}{B} \) = % of Population Listening to Radio Broadcasts by the JIS, or %

Number and Minutes of Technical Farm Programs Broadcast Weekly by Jamaica Information Service

Number of National Broadcasts/Week = \( x \) Number of Minutes/Broadcast =

Number of Minutes/Week, or minutes

---

Source: Director, Jamaican Information Service (JIS), Kingston, Jamaica (1992).
Map Of Jamaica

Location of research stations

- Montpellier
- Top Hill
- Orange River
- Horseshoe Valley
- Morant Bay
- Kingston
- St. Andrew
- St. Catherine
- Lawrencefield
- Borth
APPENDIX F
PROFILE OF INTERVIEWEES
# Profile of Research Professionals

**Interviewed - Ministry of Agriculture, Jamaica (1992)**

<table>
<thead>
<tr>
<th>Name</th>
<th>Qualification</th>
<th>Title</th>
<th>Specialty</th>
</tr>
</thead>
<tbody>
<tr>
<td>R. Baker</td>
<td>Ph.D.</td>
<td>Director of Research</td>
<td></td>
</tr>
<tr>
<td>P. Jennings</td>
<td>Ph.D.</td>
<td>Deputy Director of Research</td>
<td>Ruminant Nutrition</td>
</tr>
<tr>
<td>R. Murray</td>
<td>M.S.</td>
<td>Crop Protection Officer Principal</td>
<td>Entomology</td>
</tr>
<tr>
<td>J. Holness</td>
<td>M.S.</td>
<td>Livestock Researcher</td>
<td>Animal Breeding</td>
</tr>
<tr>
<td>A. Allen</td>
<td>B.S.</td>
<td>Director of Special Projects</td>
<td>Supervisor Special Projects</td>
</tr>
<tr>
<td>A. Dexter</td>
<td>B.S.</td>
<td>Director of Crop Research</td>
<td>Agronomy</td>
</tr>
<tr>
<td>G. Gabriel</td>
<td>B.S.</td>
<td>Agronomist</td>
<td>Agronomy</td>
</tr>
<tr>
<td>R. Blake</td>
<td>B.S.</td>
<td>Agronomist</td>
<td>Agronomy</td>
</tr>
<tr>
<td>A. Thompson</td>
<td>Diploma</td>
<td>Research Assistant</td>
<td>Animal Breeding</td>
</tr>
</tbody>
</table>
### Profile of Research Professionals

**Interviewed - Ministry of Agriculture, Jamaica (1992)**

<table>
<thead>
<tr>
<th>Name</th>
<th>Qualification</th>
<th>Title</th>
<th>Specialty</th>
</tr>
</thead>
<tbody>
<tr>
<td>L. Henry</td>
<td>B.S.</td>
<td>Director of Extension</td>
<td>Agronomy</td>
</tr>
<tr>
<td>D. Irving</td>
<td>Ph.D.</td>
<td>Deputy Director RADA</td>
<td></td>
</tr>
<tr>
<td>W. Nelson</td>
<td>B.S.</td>
<td>SMS</td>
<td>Agronomy</td>
</tr>
<tr>
<td>E. Gidden</td>
<td>B.S.</td>
<td>SMS</td>
<td>Human Resources</td>
</tr>
<tr>
<td>P. Chung</td>
<td>B.S.</td>
<td>SMS</td>
<td>Plant Protection</td>
</tr>
<tr>
<td>H. Barker</td>
<td>Diploma</td>
<td>Parish Manager</td>
<td>General Agriculture</td>
</tr>
<tr>
<td>R. Campbell</td>
<td>Diploma</td>
<td>Deputy Parish Manager</td>
<td>General Agriculture</td>
</tr>
<tr>
<td>E. Blackstock</td>
<td>Diploma</td>
<td>Deputy Parish Manager</td>
<td>General Agriculture</td>
</tr>
<tr>
<td>J. Hall Diploma</td>
<td>Extension</td>
<td>General Officer</td>
<td>Agriculture</td>
</tr>
<tr>
<td>N. Martin</td>
<td>Diploma</td>
<td>Extension Officer</td>
<td>General Agriculture</td>
</tr>
<tr>
<td>L. Richardson</td>
<td>Diploma</td>
<td>Extension Officer</td>
<td>General Agriculture</td>
</tr>
<tr>
<td>F. Chambers</td>
<td>Diploma</td>
<td>Extension Officer</td>
<td>General Agriculture</td>
</tr>
<tr>
<td>Name</td>
<td>Qualification</td>
<td>Title</td>
<td>Specialty</td>
</tr>
<tr>
<td>---------</td>
<td>---------------</td>
<td>-----------------</td>
<td>-----------------</td>
</tr>
<tr>
<td>D. Isaccs</td>
<td>Diploma</td>
<td>Extension Officer</td>
<td>General Agriculture</td>
</tr>
<tr>
<td>L. Vergin</td>
<td>Diploma</td>
<td>Extension Officer</td>
<td>General Agriculture</td>
</tr>
</tbody>
</table>
APPENDIX G
IDEAL TECHNOLOGY TRANSFER MODELS
Model 2

Public Sector (Min of Agric)
- R&D
- Extension/SMSs
- Farmer

Private Sector (Com Boards)
- R&D
- Extension
Model 3

(a) R&D Director → Marketing & Ext

(b) Field days

(c) Further on farmwork → Farmer
Model 4
Model 5

Research Station → Researcher → Farm Holdings

Ext Specialist

Parish Manager

Field Day (Farmers)
Model 6

R&D

Adaptive research
experimental trials

Verification
of results

Many Agents

R&D feedback from farmer
re needed technology

Multiplication
& spread of
new technology

Ext Agt Farmer

R&D

SMS Many Agents

Ext Agt Farmer

R&D

208
Model 7

R&D

RADA

Farmers

Subject Matter Specialists

Extension Officers
Model 8

External Sources (IIICA)
Internal Sources (Coffee Board)

Adaptation

Trial

Research stations + demonstration

Farmers

Field Days/Demonstration
Model 9

Research

New Technology

SMSs

Extension Officer

Field Days

Extension Officer

Farmers
Model 10

Research

Specialist

Extension Officer

Farmer
Model 12

Research
Tech Info
Specialist

Extension

Farmers
Model 13

Farmer

Extension Officer

Regional Office

(Media)
Model 14

Research Station

Extension Agent

Farmer

Media
Model 15

- Researcher
- Consumer Needs
- Research Thoughts
- Research Practice
- Experiment Field
- Marketing
- Extension Agent
- Commercializing (Farmer)
Model 16

- Research
  - Extension Agents
  - Farmers
Model 18

R&D

Subject Matter Specialist

External Sources

Extension Officer

Farmers
APPENDIX H
CORRESPONDENCE
June 15, 1992

R. Kirby Barrick, Professor and Chair  
Department of Agricultural Education  
Room 208 Agricultural Education Building  
2120 Fyffe Road  
CAMPUS

Dear Kirby:

The purpose of this letter is to request funding for Clive Scott's dissertation research. The main purpose of Clive's study is to describe and analyze the linkages between the public agricultural research and extension systems in Jamaica. The study is directly related to my programmatic research effort in the area of agricultural technology systems. I have attached a copy of the time line and budget for your review.

Clive applied for a Latin American Studies Travel Grant, but was turned down. At this time we do not have any source of funding for the research. We would appreciate any assistance available form the department. Thank you for your consideration.

Sincerely,

Janet L. Henderson  
Associate Professor
ESTIMATED BUDGET

1. **Travel and Transportation:**
   a. Round-trip air transportation
      (Columbus-Kingston, Jamaica-Columbus)  $ 500.00
   b. In-country transportation  __300.00__
      $ 800.00

2. **Lodging & Meals:**
   21 days @ $20/day  $ 420.00

3. **Personal Compensation:**
   Incentives for three interviewers
   ($10/day for 5 days)  $ 150.00

4. **Supplies and Materials:**
   - Copying of Questionnaires  $ 100.00
   - Copying of Government Documents  100.00
   - Cassette tapes for focus group interviews  __20.00__
      $ 220.00

**TOTAL**  $1,590.00
August 10, 1992

Dr. Paul Jennings  
Director of Research  
Ministry of Agriculture  
Hope Gardens  
Kingston 6, Jamaica

Dear Dr. Jennings:

I am interested in conducting research in Jamaica as part of my Ph.D. program in Agricultural Education at The Ohio State University. The main purpose of my dissertation research is to describe and analyze the public agricultural research and Extension systems in Jamaica. I am particularly interested in the linkages between the two systems.

I am a native of Jamaica. I have been in the United States for the past 10 years completing my Bachelor's, Master's, and doctoral degrees. Prior to leaving my country, I worked in the Ministry of Agriculture as an Extension agent in Manchester from 1979 - 1982. In the United States I have worked as an assistant manager of a nursery and as a university research associate assisting small farmers with budgeting and recordkeeping. Currently I am employed by The Ohio State University as a Graduate Administrative Associate in University College. My responsibilities include teaching a freshman orientation course and advising undergraduate students.

I have enclosed for your review a copy of the interview schedule I am proposing for my research. I also have enclosed a one-page outline of my study with a tentative time line. I plan to interview approximately 30 research and Extension personnel throughout the country. In addition to the interviews, I will be collecting data from government documents that relate to research and Extension activities in Jamaica.

As indicated on the time line, I plan to arrive in Jamaica on Thursday, August 27. My advisor will be assisting with data collection and she will arrive on Friday, September 4. We would appreciate your assistance with our study in the following areas:
1. Critically review the interview schedule and research objectives and offer suggestions for improvement.

2. Provide access to government documents containing information related to research and Extension activities in Jamaica.

3. Assist with transportation to the Boodles and Grove Place Research Stations and the Western Regional Office.

4. Provide a letter of introduction to inform the appropriate Extension and research administrators of the purpose of my study and to request their assistance.

I can be reached at the following address and telephone number in care of my major advisor:

Janet L. Henderson, Associate Professor  
Department of Agricultural Education  
Room 204 Agricultural Administration Building  
2120 Fyffe Road  
Columbus, Ohio 43210-1099  
(614) 292-0450  
(614) 292-7007 FAX

I will appreciate your assistance and cooperation with my research study. I look forward to meeting and talking with you soon.

Sincerely,

Clive Scott
August 10, 1992

Dr. Garnett Brown
Director of RADA
Ministry of Agriculture
Hope Gardens
Kingston 6, Jamaica

Dear Dr. Brown:

I am interested in conducting research in Jamaica as part of my Ph.D. program in Agricultural Education at The Ohio State University. The main purpose of my dissertation research is to describe and analyze the public agricultural research and Extension systems in Jamaica. I am particularly interested in the linkages between the two systems.

I am a native of Jamaica. I have been in the United States for the past 10 years completing my Bachelor's, Master's, and doctoral degrees. Prior to leaving my country, I worked in the Ministry of Agriculture as an Extension agent in Manchester from 1979 - 1982. In the United States I have worked as an assistant manager of a nursery and as a university research associate assisting small farmers with budgeting and recordkeeping. Currently I am employed by The Ohio State University as a Graduate Administrative Associate in University College. My responsibilities include teaching a freshman orientation course and advising undergraduate students.

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I will appreciate your assistance and cooperation with my research study. I look forward to meeting and talking with you soon.

Sincerely,

Clive Scott
Proposed Topic:
A Descriptive Analysis of the Public Agricultural Research Extension Systems: A Case Study.

Purpose:
The purpose of this study is to describe and analyze the public agricultural research and extension systems in Jamaica with a focus on the linkages between the two systems. An important element to the success of any extension organization is the linkages that exist between the extension organization and the sources of knowledge.

Objectives:
The specific objectives of the study are to:

1. Determine access to external knowledge and technology of Jamaican agricultural researchers.

2. Assess human resources for agricultural research in Jamaica.

3. Assess Jamaican resource allocations to salaries and research programs.

4. Describe Jamaican resource allocation to commodity research.

5. Determine access to and availability of internal technology to extension agents from agricultural researchers.

6. Assess personnel resources for the public agricultural Extension system in Jamaica.

7. Assess personnel administration and supervision for the Jamaican public agricultural Extension system.

8. Determine time allocated by Jamaican Extension agents to the transfer of agricultural technology.

9. Assess allocation of financial resources between agricultural Extension agents salaries and programs.

10. Describe the technology transfer activities performed by Jamaican Extension agents.
## PROPOSED TIME LINE

<table>
<thead>
<tr>
<th>DAY</th>
<th>ACTIVITY</th>
<th>LOCATION</th>
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<tbody>
<tr>
<td>August 28</td>
<td>Arrive in Jamaica</td>
<td>Kingston</td>
</tr>
<tr>
<td>29 - 30</td>
<td>Open</td>
<td>&quot;</td>
</tr>
<tr>
<td>31</td>
<td>Meet professionals of the Ministry Agriculture</td>
<td>&quot;</td>
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<tr>
<td>September 1 - 4</td>
<td>Collect and review government documents</td>
<td>&quot;</td>
</tr>
<tr>
<td>4</td>
<td>Arrival of research advisor</td>
<td>&quot;</td>
</tr>
<tr>
<td>5 - 6</td>
<td>Open</td>
<td>&quot;</td>
</tr>
<tr>
<td>7 - 8</td>
<td>Interview Research and Extension Administrators</td>
<td>&quot;</td>
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<td>9</td>
<td>Interview Researchers</td>
<td>Bodles Research Station</td>
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<tr>
<td></td>
<td>Interview Extension Agents</td>
<td>Parish/Office May Pen</td>
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<td>Interview Researchers</td>
<td>Grove Place Research Station</td>
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<td>Interview Researchers</td>
<td>Montpellier Research Station</td>
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<td></td>
<td>Interview Extension Agents</td>
<td>Parish/Office St. James</td>
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<td>12 - 13</td>
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<tr>
<td>14</td>
<td>Departure of Research advisor</td>
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<tr>
<td>15 - 18</td>
<td>Collect and Review Government Documents</td>
<td>Kingston</td>
</tr>
<tr>
<td>19 - 20</td>
<td>Open</td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>Depart from Jamaica</td>
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</tr>
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</table>
REFERENCE LIST


