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BASELINE STUDY OF AGRICULTURAL RESEARCH, EDUCATION,
AND EXTENSION IN JAMAICA

PREPARED BY

THE UNIVERSITY OF KENTUCKY

IN COOPERATION WITH

THE JAMAICAN MINISTRY OF AGRICULTURE

THE JAMAICAN MINISTRY OF EDUCATION

THE UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT

DECEMBER 15, 1979

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PREFACE

The American members of the Baseline Study Team arrived in Jamaica on June 14, following a three day briefing session on the baseline methodology which was conducted in Washington, D.C. by USAID. Jamaican counterparts from the Ministry of Agriculture and the Ministry of Education cooperated fully with the team throughout its stay, although their on-going program responsibilities rendered it impossible for them to devote full time to the study. In addition to those Jamaican officials who were designated as counterparts, the team found ready access to, and cooperation from, the wide array of administrators, technicians, and practitioners whose participation is required for the successful completion of a study of this nature.

A sincere and serious attempt was made to adhere as closely as possible to the Baseline Methodology developed by and provided to the team by BIFAD. Although the methodology provides a logical and objective framework for evaluating a country's research, education, and extension system, many of the data required to fully implement this approach are simply not available in a developing country. Some portions of the methodology would be extremely difficult to fulfill even with the information processing and retrieval systems available in the most economically advanced nations. Thus, implementation of the methodology required a substantial amount of judgement on the part of individual team members and their counterparts at all stages of the study, and entailed the making of a number of assumptions whose validity may be subject to challenge.

Despite these problems, the team feels that a reasonably accurate and complete picture of the REE system, its strengths and weaknesses,

has been developed in the course of the study. There is also apparently substantial agreement that major problem areas requiring attention have been identified and a meaningful dialogue established in terms of specific actions needed to satisfactorily address them. Two seminars held in the USAID/Jamaica offices on July 19 and July 24, and well attended by representatives of the various Jamaican research, education, and extension institutions, have aided in the refinement of the recommendations resulting from this study. On August 1, members of the team met with the Board of Managers of the Jamaica School of Agriculture to discuss its recommendations for the School. It should be emphasized, however, that there is no implied consensus on all of the recommendations -- nor was one anticipated or sought. Thus, these recommendations are to be viewed as those of the Team and although there is general support for most, they do not represent acceptance by the Government of Jamaica or the United States Agency for International Development.

The team departed Jamaica on August 3 after preparing a draft report. Upon receiving comments from USAID/Jamaica on the report, it was revised. Professors Anshel and Massey returned to Jamaica December 4-8 to discuss the final draft with Jamaican and AID officials. On December 10, Professors Anshel and Brannon presented the draft report to BIFAD and LAC/RD.

The team wishes to thank the many individuals who generously made available their time and knowledge to the team. Special thanks go to Ms. Cecil Brooks, Ruth Spence, Sue Songlin, Milyne Cathey and Donna Dickerson for their efforts to type readable and accurate drafts of the report.

SUMMARY OF RECOMMENDATIONS

Recommendations include three main types of activities, training, improvement of physical facilities and improvement of management. It was the consensus of the team that in each of the three sectors training represents the most critical need. The mix of in-service, external short-term and external degree training needed varies considerably among the sectors, however. Improvement of physical facilities could improve the efficiency of the present staff and such improvement will be essential as a better trained and, in some cases, enlarged staff is acquired. Many of the recommendations which might be broadly grouped as improved management are already being studied or implemented. They are included because the team wished to reinforce the moves in this direction.

General Recommendations

1. *Maintain the presently planned structure of the REE system and test it for a period of time.* The structure being adopted appears workable and should be allowed to solidify and be subject to the test of time.
2. *Develop salary structure, advancement policies and recruitment policies which favor the recruitment and retention of agriculturally trained officers in the REE system.* Staff turnover is detrimental to the ongoing REE program. The solution will require competitive salary levels, improved personnel procedures, active recruitment of skilled and motivated individuals and opportunities for upward mobility through training.

Education Recommendations

1. *Improve and expand the Jamaica School of Agriculture.* JSA lacks capacity to prepare agriculturalists in sufficient quantity and quality to meet Jamaican needs. This recommendation includes the upgrading of faculty (80% with a graduate degree within 10 years) renovation and expansion of facilities, improvement of equipment, improvement of the curriculum particularly with respect to practical training and eventually consideration of a B.S. level program.
2. *Strengthen agricultural programs in all-age schools.* For some time most farmers will receive no education beyond the all-age school level. The all-age schools offer an opportunity to provide agricultural training for many of the future farmers in Jamaica. Such training can introduce these potential farmers to the concept of modern agricultural production and improve their receptivity to extension and other educational programs.
3. *Introduce a vocational agriculture student organization.* Such an organization can provide an important tool for motivation, instruction and leadership development.
4. *Introduce a community outreach program for agriculture in the secondary schools.* Such a program can improve the feedback from the farming community to vocational education, provide a motivating force for teachers and students and, if properly coordinated with extension officials, supplement and build upon their efforts.
5. *Increase articulation between pre-service and in-service education of agricultural teachers.* JSA faculty and vocational agriculture teachers at all levels must have continuing opportunities to

maintain and improve their agricultural knowledge and skills. Otherwise their training and hence their teaching will become outdated.

6. *Strengthen the self-help philosophy at JSA.* The financial condition of JSA is such that more assistance from students in its operation and development is needed; likewise, JSA students need the experience of working to maintain and develop the institution.

Research Recommendations

1. *Prepare a long range plan for the development of a comprehensive research program and for the development of staff and facilities.*
The IBD agricultural research project should be used as a basis for developing and implementing long range plans. Staffing requirements in particular require greater attention.
2. *Establish an overall research program which is based upon priority research areas.* The diversity of Jamaican agriculture coupled with obvious manpower and financial limits to the size of the research effort which Jamaica can support means that the allocation of research support must be subject to rigorous evaluation of its potential for payoff in terms of achieving Jamaican development goals.
3. *Establish a research coordinating committee.* The high cost of effective research and limitations on the overall level of research activity mandate that the research by various public and/or private agencies be closely coordinated and that research activities be closely coordinated with extension and educational activities.

4. *Improve recruitment and personnel management procedures.* In addition to correcting salary gaps attention should be given to identifying and encouraging potential researchers early in their academic program.
5. *Improve personnel evaluation procedures.* Researchers do not generally feel that superior performance is rewarded or unsatisfactory performance punished.
6. *Establish closer working relationships between extension and research.* Research and extension workers at all levels must understand and truly accept the interdependence of their functions.
7. *Devise procedures to improve the availability of imported research supplies, equipment, and spare parts.* Jamaica will continue to be dependent on imports for much research equipment and supplies. The dollar value of such items is very small but their lack can totally disrupt ongoing research.
8. *Base research personnel at research stations.* Effective research in many areas requires close day-to-day observation and care. Research requiring such close care cannot be properly conducted through periodic inspections, and research which does not require close observation should generally be done on farmers' fields.
9. *Improve security for field experiments.* Praedial larceny is a major obstacle to research at many stations. Tighter security for research plots combined with the elimination or removal of non-research activities and research activities in which yield is not being measured should provide some relief.

Extension Recommendations

1. *Strengthen the professional training of all extension professional staff through requiring all new appointees to hold at least a diploma of agriculture and establish a program for current staff to obtain advanced degrees.* By means of in-service training, degree training for specialists and MINAG participation in the JSA program, the professional training of extension staff can, over time, be raised to a more desirable level.
2. *Clarify the defined role of the extension officer at the parish level and below.* Extension workers should clearly understand that their primary role is education and that adjunct functions should be conducted so as to also serve the primary role.
3. *Improve transportation for extension staff especially at the area and division levels.* Appropriate transportation is essential to the function of the extension official. Without it the official is office-bound and simply cannot provide the type of practical instruction and on-farm interaction which is needed.
4. *Improve extension's physical facilities and equipment.* Divisional and area officers frequently lack adequate office and storage space, duplicating machines, typewriters, and visual aid equipment. Parish officers have a great need for suitable storage space for seeds, planting materials, etc.
5. *Improve coordination in extension planning and activities.* Each region should have an extension review and coordinating committee composed of the Regional Director, parish directors, and representatives of all other agencies conducting extension-type activities, programs.

It is well recognized that all recommendations cannot be implemented immediately. A prioritized and phased program is suggested on pages 182-185. External assistance projects which might be useful in implementing these recommendations are given in Annex VII at the end of this report.

BASELINE STUDY OF AGRICULTURAL RESEARCH, EDUCATION,
AND EXTENSION IN JAMAICA

CHAPTER I

INTRODUCTION

BACKGROUND

This baseline study of the research, education and extension system of Jamaica was conducted at the request of the Government of Jamaica, and carried out through a contract signed June 4, 1979, between the University of Kentucky and the United States Agency for International Development. The study team attended an orientation and training session in Washington, D.C. June 11-13, 1979, and four members of the team departed immediately for Jamaica. A fifth member joined the team in Jamaica one week later. The team departed Jamaica on August 3, 1979, after preparing the initial draft report and leaving materials for review by USAID and officials of the Government of Jamaica. Two team members returned to Jamaica December 4-8 to discuss a final draft report.

OBJECTIVE

The objective of the study was to obtain, analyze, and document information relevant to the present capacity and capability of Jamaican agricultural research, education, and extension (REE) institutions to

provide the kind, quality, and quantity of services necessary for agricultural growth and development.

The team was directed to prepare a report, to the extent feasible, in accordance with the Baseline Study Methodology. Preliminary discussions during the Washington conference June 11-13 indicated that the methodology might not be totally applicable due to lack of information in some categories. The team was advised that the methodology could be modified somewhat as required to meet the objective above.

DIVISION OF RESPONSIBILITY

As provided in the contract, one team member assumed primary responsibility for each of the areas of Research, Education, Extension, and Agricultural Economics. The fifth team member was given responsibility for studying organization and management. The Ministry of Education assigned a Jamaican counterpart, Dr. Andrew Dunbar, for education and the Ministry of Agriculture assigned Mr. Joe Suah, Mr. Roy Rainford, and Mr. Stanley Carrouthers as counterparts for Research, Extension and Agricultural Economics, respectively. Mr. D. J. Burgher prepared general descriptive and historical materials.

SOURCES

Jamaican agriculture has been studied extensively in the past few years including studies by local and foreign academicians, studies by foreign and international donor agencies, studies by regional organizations whose mandate includes Jamaica, and studies by Jamaicans developing strategies and plans for increasing agricultural exports, decreasing agricultural imports, increasing domestic food production, and

strengthening components of the REE system. The team has freely utilized the data, ideas, and suggestions contained in many of these reports. To some extent, this approach was dictated by the short period of time allotted to the study. Relying to the extent possible upon studies and reports which had already been completed also minimized the disruption of activities of Jamaican Government officials. In all, 85 reports and documents were utilized by the team in preparing this report. These are listed in Annex III.

Additional information was gathered through informal visits, scheduled interviews, and site visits. These involved contacts with government officials, officials of bilateral, regional and international institutions, officials of statutory bodies, private businessmen and farmers. Lists of institutions visited (Annex IV) and of most individuals contacted (Annex V) are appended to this report.

Informal visits usually involved a discussion of the task of the team and a discussion of the work of the visited individual and his organization. However, the corps of senior agriculturists in Jamaica is small, and many individuals have moved freely among research, education, and extension activities and are reasonably knowledgeable about all of these activities. Consequently, it was generally worthwhile to discuss many of these activities with each individual visited. Questionnaires were used to provide structure to the interviews. When the information requested required consulting records or other individuals, a part of a questionnaire would be answered at a scheduled interview and the remainder left with the individual to be completed later.

Site visits included national, regional, parish, division and area offices of the Ministry of Agriculture, the Mona campus of the University

of the West Indies, the Jamaica School of Agriculture, secondary and vocational schools, research stations, statutory boards, plantations, and private farms. To the extent possible, all offices having national responsibility for agricultural research, education, or extension were visited. Visits were also made to a number of regional and parish level institutions. Unfortunately, a visit to the St. Augustine Campus of the University of the West Indies, the institution where many Jamaicans have studied for the B.S., M.S., and Ph.D. was not provided for within the contract. Site visits were particularly useful in familiarizing the team with Jamaican agriculture and with rural conditions in Jamaica. They provided some degree of familiarization with REE facilities and with their management and utilization. The information contacts they provided with students, teachers, farmers and government personnel were also quite useful. In addition to the scheduled visits, the team made use of weekends for occasional half or full day trips to parts of Jamaica not otherwise visited. One of these, for example, was to one of the coconut growing areas more recently devastated by the lethal yellowing disease, a sight which must be seen to be fully comprehended.

USE OF BASELINE STUDY METHODOLOGY

Substantial difficulties were encountered by the team in making a serious effort to apply the Baseline Methodology. Although the methodology provides an excellent catalogue of issues which must be considered, the specific methods suggested are frequently flawed. A major problem was that much of the data called for are simply not available. Although estimates could conceivably be derived through primary data collection and opinion surveys, the resources that would be required

exceed those allocated for the study. The initial portion of the methodology required so much time for data collection that the team had insufficient time to consider and deal with the central issues of the study -- diagnosis and recommendations.

In the Jamaican case, the most detailed data base for much of the needed information is the Agricultural Census. Unfortunately, the published information is more than ten years old and of doubtful usefulness considering the rapid changes which have occurred in Jamaican agriculture. A new census has been completed, but the information had not been released prior to the completion of this study.

The large body of studies and reports concerning Jamaican agriculture contain a wealth of information, much of it quite recent. The data contained in these are, however, not usually categorized in the way required by the methodology, and the categories or variables used quite naturally vary greatly from one study to another because none of these have attempted to address research, education, and extension as a system.

Notwithstanding the problems mentioned above, the Baseline Study Methodology was quite useful in providing a conceptual framework for the study of the Jamaican REE system. The suggested approaches and procedures served to focus the effort on areas that might otherwise have been overlooked. However, due to the lack of data and the way in which data for some of the variables had been obtained, it was not possible to directly use results of the baseline methodology approach in objectively drawing conclusions. Rather, these results served more as indicators or suggestions for subjective conclusions and/or as corroborators of more intuitive conclusions of the team or conclusions reached in other

studies.

Variables used in categorizing data included:

Subject Matter Variables

Resources

Natural Resources (Land, Water, Climate)

Technical Resources

Commodities

Crops Principally for Export
(Sugar, Bananas, Citrus, Coffee, Cocoa, Coconuts, Spices)

Crops Principally for Domestic Consumption
(Vegetables, Fruits, Grains, Roots and Tubers)

Livestock & Livestock Products

Fish & Fish Products

Forests & Forest Products

Socio-Economic

Management & Operations

Marketing & Distribution
(Storage, Transportation, Processing, Exchange)

Social and Cultural

Policy

Client Groups Variables

Landless (0 to 1 acre)

Small (1 to 4.9 acres)

Medium (5 to 24.9 acres)

Medium Large (25 to 99.9 acres)

Large (100 or more acres)

Functional Variables

Education

Extension

Research

No attempt was made to use geographic variables because of the small size of Jamaica and the fact that political boundaries for which data are available include a wide spectrum of topography, climatic zones, soil type, farming systems, and farm sizes.

DESCRIPTION OF REPORT

This report is presented in five chapters. In this chapter we have attempted to describe the background and purposes of the study, and its methods, and data sources. In the following two chapters the most critical constraints to the development of the Jamaican REE system are discussed. In Chapter II, the recent decline of the Jamaican economy is described and the impact on the agricultural economy and REE system briefly noted. Chapter III contains a description of Jamaican agriculture with implications for the growth of the REE system. Chapter IV describes the components of the REE system and its strengths and weaknesses. Recommendations are presented in the last chapter.

Several annexes are added to the report including a detailed description of the Jamaican agricultural economy and public sector objectives for the agricultural economy. Also included in an annex are synopses of six projects which if funded and implemented, would result in the partial achievement of the recommendation of this report. A brief description of Jamaica's experiment stations is included. Finally we list the institutions visited, the individuals formally and informally interviewed by the team, and the published materials reviewed by the team.

CHAPTER II

THE ECONOMY AND ITS IMPACT ON THE REE SYSTEM

Jamaica emerged from colonialism with a dualistic economy composed of a modern sector (based on extractive industries, tourism, and estate agriculture utilizing modern, capital intensive technologies producing for export to the more developed countries) and a traditional sector in the agricultural and service sectors producing for the domestic market and utilizing labor-intensive, low productivity technologies. Much of the modern sector was foreign-owned and was concentrated in relatively few hands.

Led by the bauxite and tourist industries, the economy grew during the 1950's and 60's, at a rate of 6-7 percent per annum.^{1/} The benefits of the growth failed to trickle down to the bulk of the population, and the initially unequal income distribution grew increasingly skewed. Between 1958 and 1969, the share of national income of the poorest 40 percent of the population declined from 7.2 percent to 5.4 percent, while unemployment rose from 13 percent of the labor force in 1962 to 23 percent in 1972.^{2/}

The Jamaican economy of the 1970's continues to be dominated by export industries, with their value continuing to account for 60-70

^{1/} Jamaica, National Planning Agency, Five Year Development Plan 1978-82 (Second Draft). Parts I-III, Kingston, p. 11-3.

^{2/} Ibid.

percent of national income. Bauxite, sugar, and tourism earn 80 percent of Jamaica's foreign exchange.^{1/}

In 1975, raw materials constituted 48 percent of all imports; capital goods, 31 percent; and consumer goods (including food), 21 percent. Food alone accounted for 12 percent of all imports. With the increased cost of oil, and despite subsequent government efforts to reduce imports, by 1977 raw materials constituted 66 percent of Jamaica's imports, while consumer goods had been reduced to 13 percent and food to 7 percent.^{2/}

In 1973, Gross Domestic Product was J\$1,734 million, or J\$878 per capita. See Tables 2.1.1 and 2.1.2. In current dollars, GDP continued to increase, reaching J\$3,932 million in 1978. In real terms, however, GDP declined substantially. After reaching a high in 1974 of J\$2,265 million, it fell to J\$2,011 million in 1978 (1974 dollars). Because population continued to increase, real GDP per person declined even faster; from J\$1,143 in 1973 to J\$940 in 1978, a decrease of 18 percent. The most seriously depressed sectors were construction and installation, distributive trade, and miscellaneous services.

Just as Jamaica's economic growth in the 1950's and 1960's was derived from rapidly expanding export industries, its recent decline can be attributed to a faltering export sector. Bauxite and alumina production peaked in 1974 and in 1975-77, production fell to levels first

^{1/} Ibid., p. 1, 2.

^{2/} Jamaica, National Planning Agency, Economic and Social Survey, 1977, Kingston, p. 5.

Table 2.1.1. Sectoral Origin of GDP in Current Prices, 1973-78.

	1973	1974	1975	1976	1977	Estimated 1978
	(J\$ million)					
<u>Agriculture, Forestry and Fishing</u>	<u>128</u>	<u>162</u>	<u>202</u>	<u>227</u>	<u>265</u>	<u>381</u>
Export Agriculture	(25)	(36)	(47)	(54)	(43)	(--)
Domestic Agriculture	(54)	(70)	(84)	(94)	(130)	(--)
Livestock	(23)	(37)	(48)	(53)	(61)	(--)
Other	(26)	(19)	(23)	(26)	(31)	(--)
<u>Mining</u>	<u>149</u>	<u>298</u>	<u>269</u>	<u>237</u>	<u>311</u>	<u>429</u>
Bauxite and Alumina	(139)	(288)	(262)	(230)	(304)	(--)
Quarrying and Refining	(10)	(10)	(7)	(7)	(7)	(--)
<u>Manufacturing</u>	<u>293</u>	<u>386</u>	<u>443</u>	<u>508</u>	<u>564</u>	<u>735</u>
Sugar, Molasses and Rum	(8)	(18)	(25)	(20)	(16)	(--)
Other Food	(79)	(120)	(139)	(171)	(192)	(--)
Textiles	(23)	(18)	(23)	(23)	(26)	(--)
Other	(183)	(230)	(256)	(294)	(330)	(--)
<u>Construction and Installation</u>	<u>178</u>	<u>214</u>	<u>252</u>	<u>209</u>	<u>174</u>	<u>212</u>
<u>Electricity, Gas and Water</u>	<u>18</u>	<u>22</u>	<u>37</u>	<u>54</u>	<u>61</u>	<u>86</u>
<u>Services</u>	<u>968</u>	<u>1183</u>	<u>1429</u>	<u>1483</u>	<u>1591</u>	<u>2089</u>
Transportation, Storage and Communications	(113)	(137)	(156)	(164)	(203)	(--)
Distributive Trades	(349)	(409)	(505)	(427)	(425)	(--)
Financial Institutions	(74)	(94)	(110)	(118)	(125)	(--)
Ownership of Dwellings	(149)	(180)	(220)	(248)	(256)	(--)
Public Administration	(186)	(251)	(317)	(389)	(437)	(--)
Miscellaneous Services	(150)	(178)	(199)	(217)	(229)	(--)
Less Imputed Service Charges	(53)	(66)	(78)	(80)	(85)	(--)
<u>GDP at Current Market Prices</u>	<u>1734</u>	<u>2265</u>	<u>2632</u>	<u>2718</u>	<u>2966</u>	<u>3932</u>
	(as % of total)					
Agriculture	7.4	7.2	7.7	8.4	8.9	9.7
Mining	8.6	13.2	10.2	8.7	10.5	10.9
Manufacturing	16.9	17.0	16.8	18.7	19.0	18.7
Construction	10.3	9.4	9.6	7.7	5.9	5.4
Electricity, Gas and Water	1.0	1.0	1.4	2.0	2.1	2.2
Services	55.8	52.2	54.3	54.6	53.6	53.1
of which: Public Administration	(10.7)	(11.1)	(12.0)	(14.3)	(14.7)	(--)

Source: Department of Statistics.

Table 2.1.2. Sectoral Origin of GDP in Constant Prices, 1973-78.

	1973	1974	1975	1976	1977	Estimated 1978
(JSS million, 1974 prices)						
<u>Agriculture, Forestry and Fishing</u>	<u>159</u>	<u>162</u>	<u>164</u>	<u>167</u>	<u>175</u>	<u>191</u>
Export Agriculture	(33)	(36)	(32)	(36)	(29)	(30)
Domestic Agriculture	(66)	(70)	(72)	(69)	(81)	(89)
Livestock	(39)	(37)	(41)	(43)	(46)	(49)
Other	(21)	(19)	(19)	(19)	(19)	(23)
<u>Mining</u>	<u>261</u>	<u>298</u>	<u>228</u>	<u>184</u>	<u>215</u>	<u>223</u>
Bauxite and Alumina	(251)	(288)	(221)	(178)	(210)	(217)
Quarrying and Refining	(10)	(10)	(7)	(6)	(5)	(6)
<u>Manufacturing</u>	<u>380</u>	<u>386</u>	<u>385</u>	<u>373</u>	<u>352</u>	<u>348</u>
Sugar, Molasses and Rum	(16)	(18)	(17)	(17)	(14)	(14)
Other Food	(111)	(120)	(124)	(129)	(128)	(120)
Textiles	(16)	(18)	(17)	(17)	(18)	(18)
Other	(237)	(230)	(227)	(210)	(192)	(196)
<u>Construction and Installation</u>	<u>231</u>	<u>214</u>	<u>215</u>	<u>176</u>	<u>143</u>	<u>129</u>
<u>Electricity, Gas and Water</u>	<u>22</u>	<u>22</u>	<u>23</u>	<u>24</u>	<u>23</u>	<u>24</u>
<u>Services</u>	<u>1206</u>	<u>1183</u>	<u>1229</u>	<u>1170</u>	<u>1103</u>	<u>1096</u>
Transportation, Storage and Communications	(124)	(137)	(142)	(135)	(141)	(146)
Distributive Trades	(492)	(409)	(432)	(343)	(315)	(315)
Financial Institutions	(86)	(94)	(101)	(93)	(89)	(87)
Ownership of Dwellings	(173)	(180)	(182)	(183)	(179)	(183)
Public Administration	(223)	(251)	(265)	(312)	(287)	(268)
Miscellaneous Services	(174)	(178)	(175)	(173)	(162)	(169)
Less Imputed Service Charges	(66)	(66)	(68)	(69)	(70)	(72)
<u>GDP at Current Market Prices</u>	<u>2259</u>	<u>2265</u>	<u>2244</u>	<u>2094</u>	<u>2011</u>	<u>2011</u>
(as % of total)						
Agriculture	7.0	7.2	7.3	8.0	8.7	9.5
Mining	11.6	13.2	10.2	8.8	10.7	11.1
Manufacturing	16.8	17.0	17.2	17.8	17.5	17.3
Construction	10.2	9.4	9.6	8.4	7.1	6.4
Electricity, Gas and Water	1.0	1.0	1.0	1.1	1.1	1.2
Services	53.4	52.2	54.8	55.9	54.8	54.5
of which: Public Administration	(9.9)	(11.1)	(11.8)	(14.9)	(14.2)	(13.3)

Source: Department of Statistics.

attained in 1969 and 1970.^{1/} In constant prices, the value of bauxite and alumina exports also peaked in 1974.^{2/} After falling dramatically in 1975 and 76, by 1978 they had recovered somewhat but were still only about 80 percent of the 1974 high.

During this same period, the tourist industry suffered an even more severe decline. After reaching their highest level in 1974, tourists' expenditures were only J\$96.1 million in 1977, a decline of J\$25.1 million from 1974.^{3/} In real terms this represents a decline of 65 percent.

Further aggravating the foreign exchange problem is the secular decline of agricultural exports due to increased domestic consumption of formerly exported crops, factory inefficiency in the sugar industry, a restructuring of the estate industry into cooperatives and privately owned farms, and unfavorable weather. Although in current prices exports continued to increase, in real terms they declined between 1973 and 1978. From 1973 to 1977 (in 1974 dollars) Jamaican exports declined from U.S.\$866.8 million to U.S.\$646.9 million and only increased to U.S.\$730.6 million in 1978.^{4/}

At the same time, import expenditures were increasing rapidly, partially because of increased demand for foods but more importantly because of increases in petroleum prices. In 1972, Jamaican petroleum

^{1/} World Bank, Current Economic Position and Prospects of Jamaica, Report No. 2504-JM, Washington, D.C., 1979, pp. 100-101.

^{2/} Ibid., p. 62.

^{3/} Jamaica, Statistical Yearbook of Jamaica, 1978, Kingston, 1979, p. 550.

^{4/} World Bank, Current Economic Position and Prospects of Jamaica, Report No. 2504-JM, Washington, D.C., May 1979, p. 62.

imports totaled U.S.\$55.5 million; only 6 years later they amounted to U.S.\$207 million.^{1/} Petroleum represented 24 percent of all imports in 1978, as compared to 9 percent only six years earlier. The result was a severe trade deficit, a very rapid inflation and a decline in real income.

This deteriorating economic situation has led to significant changes in government policy.^{2/} With assistance from the International Monetary Fund, the Government of Jamaica has undertaken a vigorous and stringent program for returning the economy to a more stable position. This has included:

- a) a flexible exchange rate policy which resulted in a devaluation of the Jamaican dollar from J\$1.00 = U.S.\$1.10 in April 1977 to J\$1.00 = U.S.\$0.561 in May 1979;
- b) constraints on price, wage, and salary increases;
- c) fiscal constraints to reduce inflationary pressures;
- d) import restrictions; and
- e) increased taxes.

This program has had significant impact on reducing Jamaica's trade deficit and improving its fiscal and income situation. The deficit in current trade account has been reduced to half its 1976 level. The decline of GDP at constant market prices has been stopped, and the decline in per capita GNP slowed.

At the same time, however, these policy actions have had significant and adverse effects on the agricultural sector and its research,

^{1/} Ibid., p. 63.

^{2/} Ibid., p. 102.

education, and education systems. The most immediate impact on agriculture results from the controls on imports. As a result, critical factors of production have been in extremely short supply. Fertilizer and other agrochemical use has declined. Maintenance of farm machinery, equipment, and vehicles has suffered and long delays have been experienced in accomplishing necessary repairs because of parts shortages. It has not been possible to replace obsolete and/or inoperable machinery and equipment, and even such basic tools as machetes have been in short supply.

The REE system has been similarly impacted. Basic supplies including fertilizer, chemicals, and feeds have been in short supply. Overall, fixed capital stocks have depreciated, and operating capital in support of research, demonstrations, and educational programs has declined to the point that the quality of these programs has been jeopardized. The result has been a decline in overall program activity.

Since actions taken to stabilize wages and salaries are more easily enforced in the public sector than in the private, pay scales for REE employees have become increasingly less competitive with private sector pay scales. The REE system confronts a major challenge in attempting to retain the services of its most capable employees.

Possibly the most severe impact has been felt by the Jamaica School of Agriculture which is currently operating at a deficit. Its physical plant has deteriorated significantly, substantial portions of its equipment are inoperative, and its student-faculty ratio has steadily risen. There even had been some public discussion of whether JSA could open for the current academic year.

CHAPTER III

IMPACTS OF JAMAICA'S AGRICULTURAL ECONOMY

ON THE REE SYSTEM

INTRODUCTION

In order to better understand the current structure and problems of the REE system, it must be placed in the broader perspective of the agricultural economy that it is designed to serve. The structure of the agricultural sector to a large extent establishes the parameters within which the REE system must operate, and defines the problems which it must address. In this chapter, two major characteristics of the structure of Jamaican agriculture are briefly summarized, and implications for the REE system are explored.^{1/}

THE DIVERSITY OF JAMAICAN AGRICULTURE

The hallmark of Jamaican agriculture is diversity -- diversity in farm sizes, crop and animal products, and agro-climatic conditions. Although Jamaica lies only 18 degrees north of the equator, its variation in altitude from sea level to 7,600 feet, and in rainfall from 30 inches in some areas to over 250 inches in others permits an unusual variety of crops to be grown. In the flat, dry coastal plains, irrigated sugar estates predominate. In the wetter coastal areas are

^{1/} For a fuller description of Jamaica's agricultural economy, see Annex I.

coconut and citrus estates. At higher altitudes, bananas, plantain, yams, cocoa, pimento, and cassava are produced. Still higher in the mountains are found coffee and temperate fruits. Jamaica exports substantial quantities of six agricultural products: cane sugar, bananas, citrus, coffee, cocoa, and pimento, and small quantities of several others (coconuts, tobacco, ginger, flowers, and ornamental plants). Domestically consumed agricultural products are even more numerous. Among the more important are yam, coco yam, pumpkin, tomato, cabbage, watermelon, corn, plantain, mangoes, sweet and Irish potatoes, and cassava. Significant quantities are also produced of honey, kola-nuts, rice, pineapple, papaya, peaches, onion, peppers, thyme, okra, cucumber, cho cho, carrot, beet root, peanuts, peas, and beans. Even this represents only a partial listing. (Annex Tables I.1.4 and I.1.5 show the production of the more important commodities.)

The diversity of agricultural products and the heterogeneity of agro-climatic zones and microclimates create opportunities as well as problems for the Jamaican REE system. Because many of these crops are also produced in the semi-tropical areas of the more developed countries, particularly the southern United States, it is possible to build upon research conducted in those regions. Moreover, Jamaicans can and do attend universities and schools in these regions where they can receive education relevant to the specific crops grown in Jamaica.

On the other hand, diversity also creates problems. For education, curricula are difficult to design. Curricula in lower level schools educating future farmers are most useful if they emphasize the particular crops and climate and soil conditions found in the specific region, thus making central design of curricula more difficult. Institutions at

higher levels which educate civil servants and others who will be spatially mobile, or will return to different parts of the island, must provide their students with an understanding of a broad array of farming systems and crops.

Similarly, research on a multitude of crops is needed. Given the limited resources a small country such as Jamaica can afford to devote to agricultural research, there is a continual conflict between spreading these resources very thinly over a large number of enterprises and problems or concentrating on a few very important ones. Historically, the latter approach has been utilized, with the result that only the research needs of a very small proportion of the agricultural community, the larger farmers, were fulfilled. More recently, a program to meet the needs of a wide spectrum of farmers has been instituted.

In addition, the numerous agro-climatic zones make it very difficult to test findings in all of the microclimates in which they may be applicable. Although the Ministry of Agriculture has numerous experiment stations and arranges further testing in farmers' fields, it is not economically feasible to test results in each agro-climatic zone.

Similar constraints affect the Extension program. Staff must have expertise with a large number of crops grown in widely different cropping systems. Recommendations in one region or area may not be appropriate to another and even may not be appropriate to all the farmers in a single area. As a result, centralized planning and program design is likely to be flawed. Major emphasis on local planning is needed -- and is currently being instituted -- but this is precisely where the least expertise resides.

FARM SIZE

A second set of problems for the REE system emanates from the very unequal distribution of Jamaican agricultural resources and the very different characteristics of Jamaica's small and large farms.

Most fundamental is the skewed distribution of land. The most recent Agricultural Census reported that in 1968-69 farms larger than 100 acres accounted for only 0.5 percent of all farms, but contained 53.2 percent of the farm land. The smallest farms, those smaller than 5 acres, represented 78.5 percent of all the farms but controlled only 15.4 percent of the nation's farm land (See Table 3.1.1).

Table 3.1.1. Distribution of Land Among Farm Size Classes, Jamaica, 1968-69.

Farm Size	Percent of All Farms	Percent of Total Farm Acreage	Average Farm Size
0-.9 ac.	29.9	1.5	0.4 ac.
1-4.9 ac.	48.6	13.9	2.2 ac.
5-24.9 ac.	19.4	22.9	9.1 ac.
25-99.9 ac.	1.6	8.5	41.6 ac.
100 ac. and more	0.5	53.2	801.4 ac.
Total	100.0	100.0	7.7 ac.

Derived from Table I.1.3.

Table 3.1.2 presents an estimate of the distribution of the value of agricultural production among farm size classes in 1977. The smallest group, 0 to .9 acres, earned 8.6 percent of 1977 agricultural revenues but constituted 29.9 percent of all farms in 1968-69. On the other hand, the largest farms, which accounted for 0.5 percent of all farms, produced almost 30 percent of gross agricultural revenues. Farms greater than 25 acres, 2.1 percent of the total, produced as much revenue as farms smaller than 5 acres which constitute 78.5 percent of the farms.

Table 3.1.2. Comparison of the 1977 Distribution of Agricultural Revenues and 1968-69 Farm Numbers and Revenues per Farm by Farm Size, Jamaica.

Farm Size	Percent of Revenues	Percent of Farms	Gross Revenue per Farm
0-.9 ac.	8.6	29.9	J\$ 1,006
1-4.9 ac.	28.1	48.6	J\$ 1,326
5-24.9 ac.	26.8	19.4	J\$ 3,160
25-100 ac.	7.0	1.6	J\$ 10,179
100 ac. and more	29.4	0.5	J\$131,530
All	100.0	100.0	J\$ 2,291

Derived from Tables I.1.3 and I.1.7.

The large and small farms have very different characteristics. Medium-large and large farms, those over 25 acres, are located on Jamaica's coastal plains and in the interior mountain valleys. They derive the bulk of their revenues from the production of sugar, beef,

and poultry, and account for most of the nation's production of sugar, citrus, coconut, beef, and dairy products (See Table 1.1.8). Given their dominance of the production of sugar and citrus, large farms generate the bulk of Jamaica's agricultural export earnings.

These larger farms are relatively capital intensive, tend to occupy the most productive agricultural lands (which frequently, however, require irrigation or drainage) and have access to a generally well developed infrastructure. In recent years, their productivity has declined due to the poor maintenance of infrastructure, lack of experienced management, declining efficiency in the marketing system, disease problems, labor unrest, and lack of spare parts, machinery replacements, and agrichemicals.

Jamaica's smaller farmers (less than 25 acres) are found throughout the country, but are heavily concentrated on the hillsides of the interior. Although they produce most of the food which they consume, they are not true subsistence farms. Although the bulk of their income is derived from domestically consumed crops (particularly yams and poultry), they also produce over 50 percent of Jamaica's bananas, cocoa, coffee, potatoes, sheep, hogs, and goats.

These farms are labor intensive. Most of the labor is provided by the farm family, but significant quantities of labor are also hired for planting and harvesting. Primary reliance is placed upon hand tools, particularly the machete and hoe, rather than mechanization. Production is constrained by steeply sloped, poor quality soils that are subject to erosion. Other constraints include difficulties in obtaining labor, lack of modern technologies, lack of secure tenure, lack of credit, poorly articulated and inefficient markets, relatively poor access to

infrastructure (particularly roads, electricity and water) and, in recent years, short supplies of tools and fertilizer.

The problems and needs for REE system services differ substantially between large and small farms. The larger farms depend on the educational subsystem to educate its management personnel to the diploma and degree level. Inasmuch as the large farming systems are well established, they require solution to rather specific research problems -- improved varieties and breeds, disease and insect control, improved plant and animal nutritional programs, improved mechanization, improved market structure and methods, for example. Extension of these types of innovations is relatively simple since the managers are relatively well educated, the organizational changes are not great, and there are few large farms to deal with. A few well trained and spatially mobile extension workers, using personal contact and written materials, can adequately disseminate the required information.

Small farmers require very different REE services. Most small farmers end their education at the primary or, at the most, secondary levels. Hence, educational programs to meet their needs must be pitched at a much lower level. Research to meet the needs of small farmers is much more difficult because they produce a much more diverse array of crops, usually in a mixed farming system, and because historically much less research has been conducted on these crops. Moreover, the small farms represent a wider array of soil and climatic conditions. The achievement of significant progress in addressing the needs of small farmers may require the development of new cropping systems.

Extension programs for small farmers are also more complex and more demanding of resources. The extension worker must deal with a large

number of poorly educated farmers who have limited access to the mass media. Not only must minor modifications of existing farming systems be introduced, but also wholly new systems, a much more difficult enterprise. Requirements will vary significantly from place to place, thus making central design of extension programs difficult. Moreover, in Jamaica it is extension's role to assist small farmers to obtain additional resources including land, capital, equipment, and buildings.

Ideally, extension workers serving small farmers must be as well educated as those working with large farmers, because they must understand the farming systems in use and adapt the ones being extended to the specific conditions of the farmers whom they serve. However, given the large numbers of workers, it is not realistic to expect that this level of training can be achieved quickly. Moreover, because of the necessity of frequent interaction with farmers in a limited geographic area, close proximity to research workers is also not feasible.

Thus, the program content, resource needs, and organization of an REE system designed to serve small farmers differs substantially from one designed to serve large farmers. This has created a conflict within the Jamaican REE system with regard to organizational structure and resource allocation.

Superimposed upon this conflict are the dual objectives of increasing export earnings in order to reduce the foreign exchange deficit and of restructuring the agricultural sector more equitably while expanding domestic food production. The Jamaican Government has opted to place primary emphasis on the latter course while still maintaining some services to the estate sector.

SUMMARY

This chapter has attempted to explore the implications for the REE system of two primary characteristics of Jamaica's agriculture -- a diversity of crops and agro-climatic zones, and a dualistic economy composed of small farms producing primarily for the domestic market and large farms producing export crops.

The diversity of crops and agro-climatic zones makes it difficult for the REE system to adequately meet all the demands for its services. It is faced with the choice of attempting to concentrate its resources on a few crops and agro-climatic zones in the hopes of serving them well or attempting to satisfy as many of the demands for its services as possible. During the colonial period the former approach predominated, and major emphasis was placed on meeting the needs of large farmers producing export crops and livestock. After independence, the REE system was redirected to attempt to meet the needs of as large a proportion of the farming population as possible. Inherent in this approach is the danger that inadequate resources will be devoted to a specific need to adequately meet it.

Second, independent Jamaica inherited a dualistic agricultural sector from the colonial period. Although the Government of Jamaica is attempting to eliminate this problem, large farms still are very important to the economy for they are the source of a major proportion of the export earnings and agricultural produce of the nation. However, it is the small farms which produce most of the nation's food supply.

Given the major difference between large and small farms in terms of resource base, farming systems, products, and management capability and production constraints, the REE system and the nation are faced with

a major allocative and organizational conflict. Organizations and programs designed to meet the needs of one sub-sector will be poorly adapted to the needs of the other.

Superimposed upon this is the dual policy objectives of expanding exports to alleviate the foreign exchange deficit and reducing the inequities inherent in the received distribution of resources. The government has opted to place a higher priority on reducing inequities and expanding the domestic food supply. This is the more difficult choice for the REE system for it means assisting a widely scattered, poorly educated clientele to obtain increased quantities of resources and to adopt new farming systems.

The following chapter describes the three components of the REE system as they currently exist and the problems they confront in adapting their services to meet the needs of Jamaica's small farmers as well as continuing to provide some services to larger farmers.

CHAPTER IV

THE RESEARCH, EDUCATION, AND EXTENSION SYSTEM

AGRICULTURAL EDUCATION

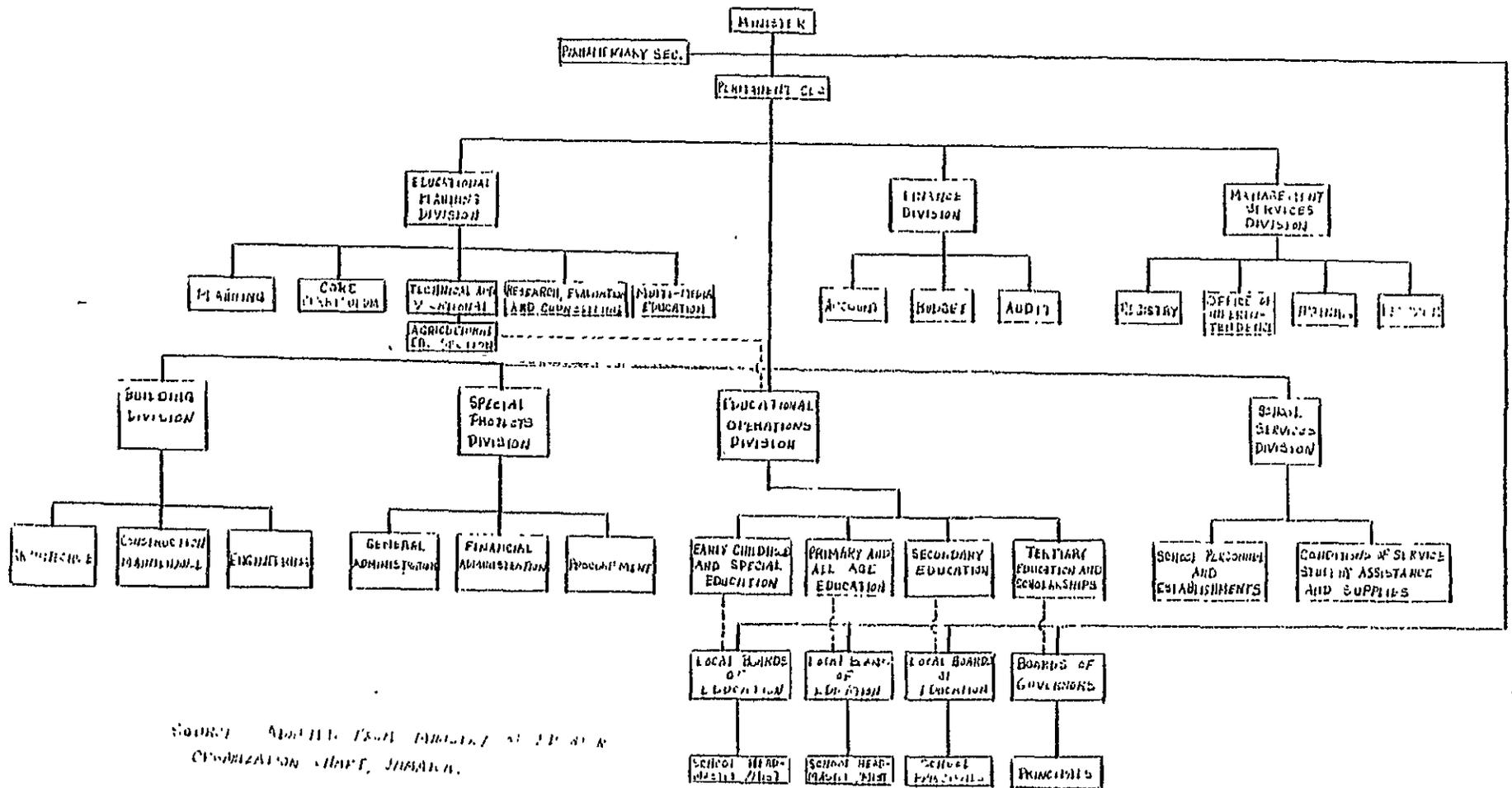
An Overview of the Structure

Organizational Structure and Administrative Responsibility.

Administrative authority and responsibility for formal education in agriculture, at all educational levels, resides with the Ministry of Education. The Ministry's organizational framework is shown in Table 4.1.1. Planning and operational responsibilities for agricultural education are delegated by the Minister of Education to the Chief, Educational Planning Division, and the Chief, Educational Operations Division, respectively.

An Agricultural Education Section within the Technical and Vocational Education Unit of the Educational Planning Division is currently staffed by four (authorized five) agricultural education specialists. A Senior Education Officer heads the specialist staff and is officed in Kingston (actually a regional education office). Each of the other Education Officers operates out of one of four regional education offices (Mandeville, Montego Bay, Ocho Rios, and Port Antonio). The members of the Agricultural Education Section maintain liaison with the Jamaica School of Agriculture and local boards of education, school principals, and teachers of agriculture through the Educational

TABLE 4.1.1. ORGANIZATIONAL DIAGRAM: MINISTRY OF EDUCATION



SOURCE: ADAPTED FROM MINISTRY OF EDUCATION ORGANIZATION CHART, JORDAN.

Operations Division and appropriate educational level units (i.e., primary and all-age education, secondary education, etc.).

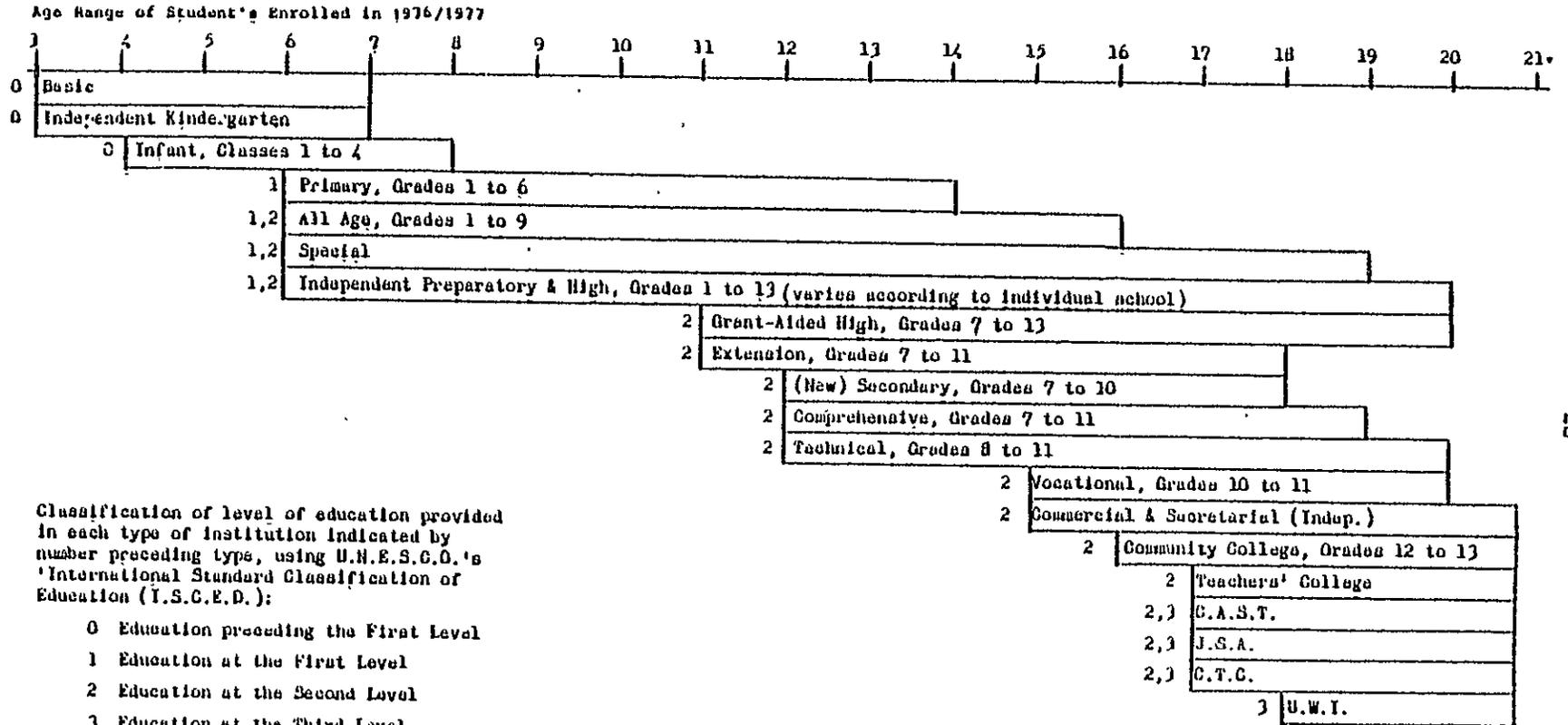
The Agricultural Education Section appears to be appropriately positioned within the Ministry of Education. Through a line relationship with the Educational Planning Division, this Section can remain in the vanguard of educational development and avoid being locked into any particular level of educational responsibility within the Educational Operations Division. It is stated policy for agricultural education to be a component of every level of education -- primary, secondary, and tertiary.

An overview of the total educational system in Jamaica is presented in Tables 4.1.2 and 4.1.3. The system is administered by the Ministry of Education through its seven major divisions. Some responsibility for local school operations is delegated by the Ministry to local boards of education and, in the case of post-secondary institutions, to boards of governors. The Minister of Education appoints the chairpersons of local boards of education and several core board members; however, most local board members are elected representatives from local community organizations such as the Parent-Teachers Association, the Ministry of Agriculture, the school's administrative staff, and the community at large.

The local school board selects the school principal and vice-principal. These positions must be advertised, candidates screened and interviewed, and three rank-ordered nominations forwarded to the Minister of Education, who makes the final decision on appointments. The local boards of education and school principals have authority to hire (and dismiss) teachers, but the Ministry determines teacher salaries and exercises final approval over all personnel actions.

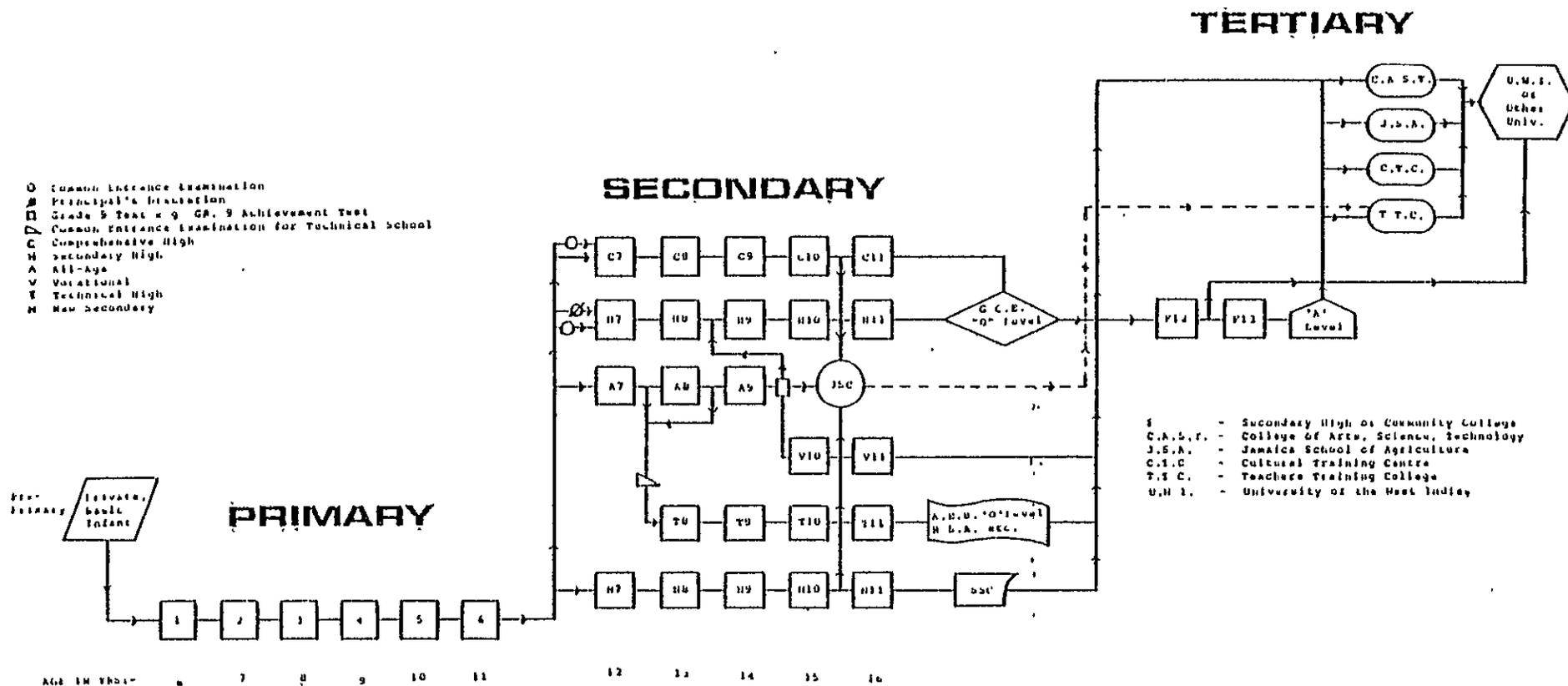
Table 4.1.2. The System of Education in Jamaica: Organization Chart

(Full-time Schools and Colleges)



Source: Educational Statistics 1976-77. Annual Statistical Review of the Education Sector. Ministry of Education, Jamaica. November 1977, p. vi.

Table 4.1.3. Flow Diagram of the Education System in Jamaica, 1977



Source: Five-Year Plan (1978-1983). Draft Two. Ministry of Education. December 1977, p. 23.

A listing of the kinds and numbers of institutions offering formal instructional programs in agriculture during 1978-79 is presented in Table 4.1.4.

Historical Evolution of the Current System

Jamaica School of Agriculture (JSA).^{1/} Formal instruction in agriculture in Jamaica began in 1910 with the establishment of the Government Farm School at Hope in the parish of St. Andrew. In 1939 this institution was renamed the Jamaica School of Agriculture (JSA), and in 1957 was relocated to its present site in Twickenham Park in St. Catherine, 10 miles west of Kingston.

The School opened with an enrollment of 26 students. By 1935 it had graduated 431 students with diplomas and certificates in Agriculture -- annual enrollments averaged 37. Enrollments increased rapidly during the 1960's and 1970's in response to the growing demand for trained agriculturalists and home economists in Jamaica and other Caribbean islands. In 1968, JSA was expanded to accommodate 448 residential students, and became a co-educational institution. The new program also offered a home economics diploma.

Official student enrollment at JSA in 1978-79 was 542. The JSA is the only institution of higher education in agriculture (and one of two schools for household sciences) in Jamaica.

^{1/} Summarized primarily from "Agricultural Education as a Component of the National Agricultural Programme," Draft One, a discussion paper prepared by Andrew D. Dunbar et al., Planning and Development Unit, Ministry of Education, Kingston, Jamaica, June 25, 1979, Appendix III. (Henceforth referred to as the Dunbar Report.)

Table 4.1.4. Kinds and Numbers of Institutions Offering Formal Education in Agriculture in Jamaica, 1978-79.

Level	Ages	Grades	Institutions	Number Offering Agriculture
1. All-Age	12-14+	7-9*	All-Age School	231
2. Secondary	12-17+	7-11	New Secondary Schools	51
			Comprehensive High Schools	2
			Secondary High Schools	9
			Technical High Schools	4
			Vocational Schools	2
3. Tertiary (including teacher education)	Entry at 17+	-	Jamaica School of Agriculture	1
			University of the West Indies (Faculty of Agriculture, Trinidad)	1

* Note: Although reference is made in Ministry of Education publications to agricultural education at the primary level, no substantiating data could be found. Agricultural education in the all-age schools is concentrated at the first-cycle secondary or junior high school level of those institutions.

The School was founded by and operated as a department of the Ministry of Agriculture until 1957. Then a provisional Board of Governors was appointed to operate the 500 acre site as a commercial farm and to direct the affairs of the School. A year later, the provisional Board was replaced by a Statutory Board established under the Jamaica School of Agriculture law, 1958, and the Ministry of Agriculture continued to function as the official "home" of JSA.

The functions of the Board are as follows:

1. To determine and provide the standards of training to be maintained in the School;
2. To determine the examinations to be set and the diplomas and certificates to be awarded by the School;
3. To award, and when awarded, to withdraw scholarships;
4. To establish, maintain, and operate nurseries, workshops, or other work in connection with the School or farm; and
5. To conduct experiments and undertake research.

In 1974, the responsibility for oversight of JSA was transferred from the Ministry of Agriculture to the Ministry of Education.

Prior to 1968, the School conducted a three-year course of instruction leading to a Diploma in Agriculture. However, expansion of the School in 1968 was accompanied by two curricular changes: (1) introduction of a home economics (household sciences) curriculum to parallel the agriculture program; and (2) implementation of a two-tier, School-wide instructional system. The latter shortened the Diploma in agriculture (home economics) program from three years to two and installed a new three-year program leading to the Associate Degree in Science (agriculture or home economics). Further curricular

modifications occurred with the introduction of two teacher education options during the 1970's. Programs to prepare teachers for instruction at the secondary level were introduced for agriculture in 1973 and for home economics in 1975. A summary of the various academic options that were in effect at JSA until September 1978 are presented below:

1. Diploma in agriculture (home economics) -- two-year program.
2. Diploma in agriculture (home economics) with teacher certification -- three-year program.
3. Associate Degree in Science (agriculture or consumer education) -- three-year program.

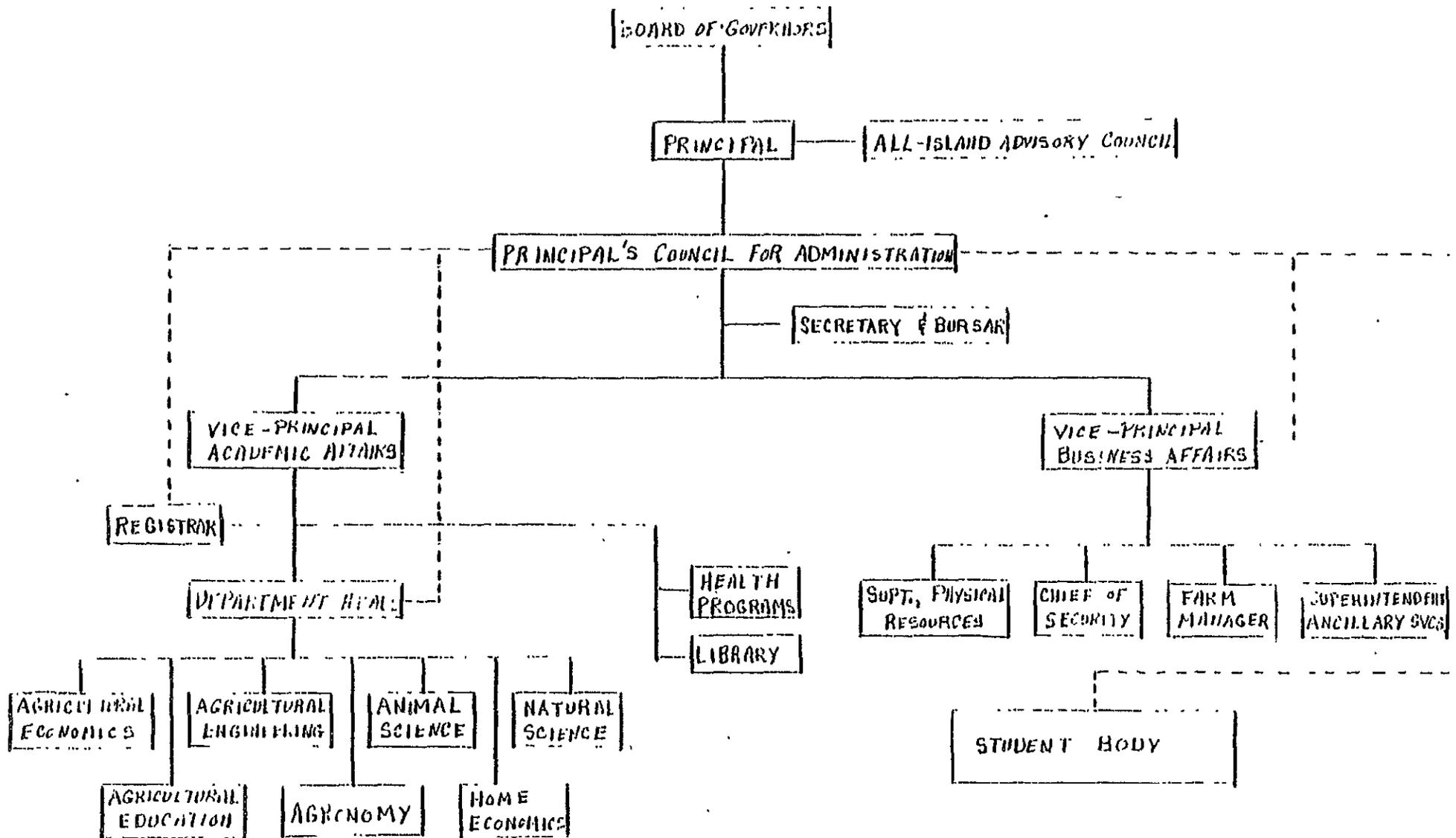
The present organizational structure of the Jamaica School of Agriculture is presented in Table 4.1.5. Its linkage to the Ministry of Education can be traced through Tertiary Education and Scholarships to the Board of Governors. See Table 4.1.1.

The JSA Board of Governors is a policy-making statutory body composed of 14 members appointed by the Minister of Education for two-year, non-staggered terms. Board membership presently includes the JSA Principal, a member from the Ministry of Education, a member from the Ministry of Agriculture, a JSA faculty member, a JSA student representative, private citizens and government officials interested in JSA.

A second group of individuals forms the All-Island Advisory Council. This committee currently consists of eleven members appointed by the Board to serve in an advisory capacity to the Principal with regard to manpower needs, operational standards, and quality of graduates.

The Principal's Council for Administration consists of two vice-principals, selected department heads and students, and the Principal, who chairs the Council. The Principal is assisted in daily school

TABLE 4.1.5. ORGANIZATIONAL STRUCTURE: JAMAICA SCHOOL OF AGRICULTURE



operations by a Vice-Principal for Academic Affairs, a Vice-Principal for Business Affairs, a secretary, and a bursar. He meets regularly with the heads of the seven academic departments and the two vice-principals, the Principal's Council, and the Board of Governors.

The Knockalva Agricultural Training Centre.^{1/} The first secondary level vocational agriculture school in Jamaica was established in 1940 as the Knockalva Agricultural Training Centre. Situated on 214 acres at Ramble in Hanover Parish, this practical training centre was elevated to the status of a rural secondary technical high school during the late forties. In 1962, Knockalva began offering a two-year program in vocational agriculture with emphasis on practical training. Students gained admission upon successful completion of an entrance examination designed by the Ministry of Education especially for entry to Knockalva. Subjects taught included English, mathematics, civics, animal husbandry, field husbandry, wood work, and metal work. However, at the end of the two-year program, students were examined by the Ministry of Education in only two subjects, field husbandry and animal husbandry.

Criteria for admission to Knockalva were changed in the late 60's or early 70's. Students are now selected from among those who successfully complete the Grade Nine Achievement Test and who choose agriculture as a vocation. The curriculum has also been broadened to include more agricultural courses as well as those subjects which are normally offered by secondary schools throughout Jamaica. Instructional time is equally divided between theoretical and practical class activities. Examinations now include tests in English, mathematics, bookkeeping, and

^{1/} Ibid., Appendix II.

general science. Although currently designated as a vocational and secondary school, Knockalva has been selected for upgrading and expansion of facilities by the Ministry of Education. Current Ministry of Education plans are to develop Knockalva into a regional agricultural school with an output of 200 vocational agriculture graduates (Grade 12) per year.

Technical High Schools. There are four technical high schools (Dinthill, Holmwood, St. Elizabeth, and Vere) which offer instruction in agriculture at the 10th and 11th grade levels. Dinthill Technical High School, like Knockalva, has been identified as one of four schools proposed for development as a regional agricultural secondary school.

Regional Agriculture Schools. Two new regional agricultural secondary schools (Elim and Passley Gardens), funded in part by AID's Rural Secondary Education Project, will each accommodate 300 vocational agriculture and home economics students in grades 10 through 12. The school at Elim, in St. Elizabeth, is already in operation. The Passley Gardens school, in Portland, is scheduled to open in 1980.

Comprehensive and Secondary High Schools. Agricultural Science is offered as a subject of study in grades 7 through 11 in two comprehensive high schools and nine secondary high schools. Although the amount of practical activities in agriculture varies considerably from school to school, these institutions give greater emphasis to the academic aspect of agriculture than do the technical and vocational schools.

New Secondary Schools. Agricultural courses are offered as a special option in those secondary institutions which have been provided with agricultural facilities and instructional staff. A total of 51 new secondary schools was identified as offering agriculture in 1978-79.

All-Age Schools. Education at the all-age schools terminates after Grade 9. This level is believed to provide most of the education for students entering the vocation of farming in Jamaica. Even though nearly 90 percent of the all-age schools are located in rural and remote areas, less than one-half of the all-age schools have school gardens or tutorial farms for their students. These plots of land range in size from one square chain (0.1 acres) up to 20 acres. Agricultural instruction, averaging about three hours per week at the grade 7, 8, and 9 levels, is believed to have been offered in the 231 schools with school gardens and/tutorial farms during 1978-79, but precise data are scarce.

The University of the West Indies (Faculty of Agriculture/Trinidad). Jamaica is a major contributor to the support of the University of the West Indies, a regional institution of higher education serving fourteen different territories and independent nations in the Caribbean. Although the main campus of the University is located at Mona, near Kingston, Jamaica, the Faculty of Agriculture is located over one thousand miles away at St. Augustine, Trinidad. Jamaica is represented on the multi-national governing body of the University (the University council) by an appointee of Jamaica's Prime Minister.

Resource Allocation by Institution

Introduction. Considerable variation exists in the amounts of resources allocated to the various agricultural education institutions in Jamaica. Data presented in this section compare physical facilities, personnel, and expenditures between all age schools, secondary level institutions, the Jamaica School of Agriculture, and the Faculty of Agriculture, University of the West Indies (UWI). Comparisons are also

made between institutions by subject matter and client group.

Physical Facilities. Resource constraints and scheduling difficulties prevented direct assessment of the physical facilities at the Faculty of Agriculture in Trinidad and the all-age schools in Jamaica. However, some general impressions were formed from interviews with persons familiar with those institutions. Composite ratings of the adequacy of agricultural facilities at technical schools and high schools, and at the Jamaica School of Agriculture, were compiled from direct observations and completion of interview schedules by agricultural instructors and administrators. Those data are shown in Table 4.1.6.

All-Age Schools. The 1976-77 educational statistics indicate that 285 of 736 primary and all-age schools had some agricultural land for instructional purposes. However, data obtained from the Agricultural Education Section, Ministry of Education, show that only 231 all-age schools are known to have school garden programs or tutorial farm programs. Those plots ranged in area from 0.1 acre to 20 acres. Agricultural equipment at the schools is limited to a few hand and garden tools.

Secondary Level Schools. Observations at two high schools, a new agricultural school (Elim), and two technical schools revealed a great range in both quantity and quality of physical facilities. The new school at Elim has an especially fine set of physical facilities, and those at Dint Hill Tech are good. However, these schools appear to be atypical. Shop facilities and laboratory facilities are poor in most secondary schools, although most other structures are satisfactory. Lack of equipment -- especially instructional equipment, farm vehicles,

Table 4.1.6. Composite Ratings of the Adequacy of Agricultural Structures and Equipment at Selected Secondary Level Schools and at the Jamaica School of Agriculture (JSA).

Secondary Level Schools	JSA	Structure	Secondary Level Schools	JSA	Structure
3	3	a) Classrooms	3	4	aa) Classroom equipment
3	3	b) Office	4	4	bb) Office equipment
4	4	c) Conference rooms	4	5	cc) Audio-visual equipment
4	3	d) Auditorium (assembly hall)	2	4	dd) Textbooks
4	3	e) Laboratories	4	4	ee) Laboratory equipment
3	4	f) Store rooms	3	4	ff) Seed & fertilizer supplies
3	5	g) Equipment storage sheds	5	5	gg) Farm vehicles (tractors/implements)
4	4	h) Farm shop	3	4	hh) Agricultural tools and equipment
2	3	i) Other farm buildings	3	5	ii) Fencing (security)
2	3	j) Library building/room	4	4	jj) Library books & journals
3	3	k) Residence halls	3	5	kk) Laundry facilities
3	4	l) Dining halls	3	5	ll) Kitchen equipment
3	4	m) Faculty housing	5	5	mm) Vehicles (automobiles, buses)
5	5	n) Gymnasium, swimming pools, etc.	3	5	nn) Athletic equipment

Note: The secondary level schools sampled included technical, agricultural, and secondary high schools.

Rating Scale: 1 = Excellent 2 = Good 3 = Satisfactory 4 = Poor 5 = Totally Inadequate

and transportation vehicles in general -- is the lament of most teachers interviewed. Library books and journals in agriculture are also in short supply.

The Jamaica School of Agriculture. For the size of enrollment and level of agricultural education, JSA has the poorest instructional facilities of all institutions visited. Productive cropland for instructional purposes totals only 20 acres, faculty office space is severely limited, many classrooms are in need of repair, the library collection would be inadequate for a secondary level program in agriculture, and audio-visual equipment is practically non-existent. Items rated totally inadequate at JSA include equipment storage sheds, recreational facilities and equipment, audio-visual equipment, farm vehicles, security fencing, laundry and kitchen equipment, and vehicles for transportation. Needed items include analytical balances, hammer and roller mills, an all-terrain vehicle, ploughs, trucks, buses, storage cabinets, all kinds of classroom equipment, laboratory supplies and spare parts for scientific instruments, to name a few.

The Faculty of Agriculture, UWI. Several Jamaican students who have attended the Faculty of Agriculture in Trinidad in recent years, as well as several faculty members at the Mona campus, have indicated that the instructional facilities at the St. Augustine campus are good, but greatly underutilized.

Summary. With the exception of JSA, physical structures for agriculture at most schools appear to be fairly adequate and serviceable. Most instructional equipment at JSA, and even in the secondary schools, was found to be inoperative due to the unavailability of replacement parts on the island. The lack of trucks and buses for transporting

students and/or hauling farm supplies was a problem at every school visited. No facilities for instruction in either aquaculture or forestry were found.

Personnel

Introduction. The number and academic specialties of instructional personnel at various levels of agricultural education, and the content of their schools' curricula, constituted a second set of factors used in determining institutional resource allocations. Data for the four levels of agricultural education were collected and tabulated for academic years 1973-74 and 1978-79, and are shown in Table 4.1.7. Also, rough estimates of the origin (size of home farm) of students enrolled in agricultural programs were made in an attempt to determine the relative allocation of instructional personnel by client group. Those data are presented as percentages of total personnel resources in Table 4.1.8.

Natural and Technical Resources. More inputs of agricultural education time and personnel were devoted to instruction in the natural and technical resources area than to any other major subject matter category, both in 1973-74 and in 1978-79. This allocation appears to be consistent with the emphasis placed on natural and physical science concepts and their practical application in most agricultural education programs. Overall, significantly more time is devoted to technical resources than to natural resources. This is especially evident in the secondary level curriculum.

Commodities. Instruction in animal science (livestock) consumes more instructional resources than any other single subject matter among

Table 4.1.7. Instructional Personnel (person-years) by Level of Instruction and Subject Matter, 1973-74 and 1978-79.

	Instructional Personnel (person-years) in Agriculture									
	All-Age Schools		Secondary Schools		JSA		Faculty/Ag., UWI		Total	
	1973-74	1978-78	1973-74	1978-78	1973-74	1978-79	1973-74	1978-79	1973-74	1978-79
A. Resources										
1) Natural	2.6	9.1	13.6	24.8	3.6	3.4	4.0	7.0	23.8	44.3
2) Technical	2.1	7.5	29.6	53.9	4.0	4.2	4.0	5.0	39.7	70.6
B. Commodity										
1) Export Crops	1.6	5.9	2.3	4.1	2.4	2.3	3.0	5.0	9.3	17.3
2) Domestic Crops	1.6	5.9	2.3	4.1	2.4	2.7	3.0	4.0	9.3	16.7
3) Livestock	3.1	10.8	9.1	16.4	7.6	6.1	5.0	5.0	24.8	38.3
4) Fish	--	--	--	--	--	--	--	1.0	--	1.0
5) Forestry	1.2	4.2	--	--	1.2	1.1	1.0	1.0	3.4	6.3
C. Home Economics/ Food Science	--	--	--	--	9.2	6.8	--	--	9.2	6.8
D. Socio-Economic										
1) Farm Management & Operation	1.2	4.2	13.6	24.8	5.2	3.1	2.0	2.0	22.0	34.1
2) Marketing & Dis- tribution	0.2	0.8	4.5	8.3	2.0	1.5	1.0	1.0	7.7	11.6
3) Social & Cultural	0.2	0.8	4.5	8.3	2.0	1.5	--	1.0	6.7	11.6
E. Public Policy	0.2	0.8	4.5	8.3	0.4	--	1.0	1.0	6.1	10.1
F. Teacher/Extension Education & Communications	--	--	--	--	--	5.3	3.0	2.0	3.0	7.3
Totals	14.0	50.0	84.0	153.0	40.0	38.0	27.0	35.0	165.0	276.0

Note: Person-years were calculated by analyzing the all-age and secondary curricula with regard to subject matter variable, weighting the instructional units accordingly, and dividing the weighted variable by the total number of agricultural teachers in those schools. In the case of JSA and UWI, faculty departmental affiliation was used instead of curricular analysis.

Table 4.1.8. Percentages of Total Instructional Personnel (person-years) by Level of Institution and Client Group, 1973-74 and 1978-79.

Client Group Variable	Percentages of Total Instructional Personnel by Level of Institution									
	All-Age Schools		Secondary Schools		JSA		Faculty of Ag., UWI		Total	
	1973-74	1978-79	1973-74	1978-79	1973-74	1978-79	1973-74	1978-79	1973-74	1978-79
1) Urban Family	5.0	6.0	5.0	6.0	5.0	6.0	5.0	6.0	5.0	6.0
2) Landless (0-.9 acre)	29.0	24.0	29.0	24.0	29.0	24.0	29.0	24.0	29.0	24.0
3) Small (1-4.9 acre)	50.0	54.0	50.0	54.0	50.0	54.0	50.0	54.0	50.0	54.0
4) Medium (5-24.9 acre)	14.5	15.0	14.5	15.0	14.5	15.0	14.5	15.0	14.5	15.0
5) Medium Large (25-99.9 acre)	1.0	0.8	1.0	0.8	1.0	0.8	1.0	0.8	1.0	0.8
6) Large (100 acres & over)	0.5	0.2	0.5	0.2	0.5	0.2	0.5	0.2	0.5	0.2

Note: The term "client group" refers in this table to the sizes of farms (if any) from whence the student body originated.

the commodities. Except for the Faculty of Agriculture, more resources are used for instruction relating to livestock than for export and domestic crops combined. Given the importance of both domestically consumed and export crops relative to livestock, a disproportionate amount of teaching resources are devoted to livestock in the Jamaican educational system. Very little time is used for instruction in forestry, and virtually none for fish production.

Home Economics/Food Science. The only measure of resource allocation to home economics/food science was applied to the curriculum at JSA. Most, but not all, of the subject matter content in this area deals with natural and physical science concepts. Nevertheless, home economics/food science had the largest faculty of any subject matter area in the JSA curriculum.

Socio-Economic. Instruction in farm management and operations consumes more instructional resources than the combined amount allocated to marketing, distribution, and social and cultural courses. This holds true for all levels of instruction; however, the Faculty of Agriculture has the most equal distribution of faculty among the three areas. The minimal attention given to marketing and distribution is a major weakness in the educational curricula at all levels.

Public Policy. This area did not comprise a significant component in any of the curricula reviewed.

Teacher/Extension Education and Communications. This subject matter forms an important component of the JSA curriculum in 1978-79, surpassed only by resources allocated to home economics/food science and animal science at the School.

Instructional Personnel by Client Group. It was impossible for most of the instructors surveyed to accurately estimate the proportion of their students by size of home farm. Some judgments were made, however, by agricultural teachers and administrators at the secondary level schools. Those percentages were applied to all levels of institutions as shown in Table 4.1.8. The percentage of students coming from urban families or farms of less than one acre was judged to be about 30 percent of the total, the same as the percentage of farms in the less-than-one-acre category for Jamaica in 1978.

However, agricultural students from small farms were thought to have been somewhat overrepresented (54 percent versus 49 percent) relative to the percentage of small farms among all farms in Jamaica during that year. The opposite situation seemed to prevail with respect to students from medium (15 percent instead of 19 percent), medium-large (0.8 percent instead of 1.6 percent) and large (0.2 percent instead of 0.5 percent); i.e., they appeared to be slightly underrepresented.

Budgetary Expenditures

Considerable effort was devoted to attempting to determine the amount of actual expenditures for each of the four levels of agricultural education during 1973-74 and 1977-78. Data concerning agricultural education program expenditures, enrollments, and numbers of institutions offering such instruction were compiled from several sources, synthesized, and are presented in Table 4.1.9. Current expenditures include both grants for agricultural programs and the estimated total salaries of agricultural teachers. With the exception of a modest capital expenditure at JSA in 1973-74, no record of capital outlay could

Table 4.1.9. Expenditures for Agricultural Education in Jamaica by Level of Institution, 1973-74 and 1977-78.

Level of Institution	Academic Year 1973-74				Academic Year 1977-78			
	Expenditures		Total	Total	Expenditures		Total	Total
	Current	Capital	Agricultural Enrollment	Expenditure Per Enrollee	Current	Capital	Agricultural Enrollment	Expenditure Per Enrollee
All-Age Schools	81,180 ^a	-	Not Available	-	322,000 ^a	-	(1976-77) ^b 36,126	\$9
Secondary Level Schools	(1975-76) ^c 615,346	-	Not Available	-	1,737,090 ^d	-	(1976-77) ^e 35,524	\$49
Jamaica School of Agriculture	870,540 ^f	32,305	335	\$2,695	1,347,973 ^f	-	522	\$2,582
Faculty of Agriculture, University of the West Indies	174,725 ^g	-	61	\$2,864	492,925 ^g	-	65	\$7,583
TOTALS	\$1,741,791	32,305	496	Average = \$2,107	\$3,899,988	-	72,237	Average = \$54

^a Estimated by combining expenditures for school gardens, tutorial farms, and agricultural competition as reported in Estimates of Expenditure, Jamaica, March 1976, and adding the estimated average all-age school teacher salary by the number of agriculturally prepared teachers believed to have been teaching in all-age schools during the years in question. Estimates of numbers of all-age agriculture teachers (14 in 1973-74 and 50 in 1977-78) were obtained from the Planning Unit and the Agricultural Education Section, Ministry of Education. Calculated from data in the Budget Unit, Ministry of Education, average annual all-age teacher salaries were figured at \$2,400 for 1973-74 and \$5,000 for 1977-78.

^b Total agricultural enrollment was obtained by multiplying the total all-age enrollment for students ages 12-17 (grades 7-11) for 1976-77 by the percentage of all-age schools with school gardens/tutorial farms (231 of 520 or 44%). See Five-year Education Plan (1978-1983), Ministry of Education, pp. 27 and 68.

^c Current expenditures were obtained from the Budget Unit, Ministry of Education, for 1975-76 (earlier data were unavailable) and supplemented by the average agricultural teachers salary in 1973-74 (estimated at \$3,000 per year) by the number of secondary agricultural teachers in 1972-73 (see Jamaica Education Sector Survey, Ministry of Education, 1977, p. 204).

^d Current expenditures were obtained for 1977-78 in the same manner as for 1975-76. The number of agricultural teachers was estimated at 153 with annual salaries averaging \$5,500.

^e Consolidated from Education Statistics, 1976-77, Ministry of Education, Jamaica, pp. 154, 156-157, 160-161.

^f Estimates of Expenditure, Jamaica, various years.

^g Obtained from the Bursary and the Development and Planning Unit, University of the West Indies, Mona, Jamaica.

be found for any of the institutions involved. This probably reflects the general weakness in the Jamaican economy in recent years.

Not surprisingly, total expenditure per enrollee rises sharply with level of instruction. A highly disturbing finding, however, is that expenditure per student at the Jamaica School of Agriculture actually declined by more than J\$100 during the five year period, 1973-74 through 1977-78, a period of rapid inflation. This fact helps to explain the deficient state of physical facilities at JSA. Furthermore, as noted in Table 4.1.7, the number of full-time instructional personnel at JSA decreased by two between 1973-74 and 1978-79 -- a period during which the School's total enrollment expanded from 335 to 542 students.

According to data reported in Estimates of Expenditures, Jamaica, for various years, the Ministry of Education total budget grew from J\$73,050,485 (recurrent budget \$66,185,641) in 1973-74 to J\$183,005,590 (recurrent budget \$168,139,966) in 1977-78. This amounted to an increase of 25.8 percent per annum (compounded). During the same period expenditures for agricultural education increased at a rate of 21.8 percent per annum, and budgetary support for JSA increased 10.5 percent per annum. Expenditures for agricultural education fell from 2.4 to 2.1 percent of the Ministry of Education budget.

Although the decline in JSA's real budget per student could be interpreted as indicating a lack of commitment to agricultural education, because it is widely believed that fiscal and personnel management of JSA has been very inefficient, such an interpretation would be questionable. The Government of Jamaica would be reluctant to provide additional funds to the school when it believed that those funds already allocated could be used more efficiently. Regardless, it appears

unlikely that even with a highly efficient administrative, that the school could withstand a .50 percent reduction in real budget per student while at the same time maintaining the quality of the School's programs and facilities. It is the team's view that a substantial increase in the School's budgetary support will be required in order to maintain its facilities and equipment and to provide necessary expendable supplies.

A summary of most of the expenditure data reviewed in this section is presented in Tables 4.1.10 and 4.1.11.

Output and Placement

Accurate data on manpower output by the agricultural education system are unavailable for levels other than tertiary. An estimate of the number of students believed to have completed or graduated from the various levels of agricultural education in 1978-79 is presented in Table 4.1.12. Grade 11 enrollments in agricultural subjects during school year 1976-77 were used in lieu of 1978-79 enrollments and projected grade 9 enrollment data for all-age schools in 1978-79 were used in formulating estimates of agricultural program completions. Column totals were omitted from Table 4.1.12 because the levels of agricultural preparation are not really comparable.

All-Age Schools. By the end of school year 1978-79, approximately 10,000 students were estimated to have completed their first cycle secondary education at those all-age schools which used school gardens or tutorial farms as learning laboratories. However, the amount of

^{1/} The Labor Force 1977, Department of Statistics, Government of Jamaica, p. xviii.

(Corrected)

Table 4.1.10. Summary of Manpower and Financial Investments in Agricultural Education by Subject Matter, Jamaica 1973-74 and 1977-78.

I. Subject Matter Variable	Personnel (Person-years)		1973-74 Expenditures		Percent of 1973-74 Expenditures	1977-78 Expenditures		Percent of 1977-78 Expenditures
	1973-74	1978-79	Current	Capital		Current	Capital	
A. Resources								
1) Natural	23.8	44.3	250,818	4,652	14.4	623,998	--	16.0
2) Technical	39.7	70.6	419,772	7,786	24.1	998,397	--	25.6
B. Commodity								
1) Export Crops	9.3	17.3	97,540	1,809	5.6	245,699	--	6.3
2) Domestic Crops	9.3	16.7	97,540	1,809	5.6	233,999	--	6.0
3) Livestock	24.8	38.3	261,269	4,846	15.0	542,098	--	13.9
4) Fish	--	1.0	--	--	--	15,600	--	0.4
5) Forestry	3.4	6.3	36,578	678	2.1	89,700	--	2.3
C. Home Economics/Food Science	9.2	6.8	97,540	1,809	5.6	97,500	--	2.5
D. Socio-Economic								
1) Farm Management & Operations	22.0	34.1	231,658	4,297	13.3	479,699	--	12.3
2) Marketing & Distri- bution	7.7	11.6	81,864	1,518	4.7	163,799	--	4.2
3) Social & Cultural	6.7	11.6	71,414	1,325	4.1	163,799	--	4.2
E. Public Policy	6.1	10.1	64,446	1,195	3.7	144,300	--	3.7
F. Teacher/Extension Educa- tion & Communications	3.0	7.3	31,352	581	1.8	101,400	--	2.6
Totals	165.0	276.0	1,741,791	32,305	100.0	3,899,988	--	100.0
			1,774,096					
1. Natural & Physical Science	119.5	201.3	1,261,057	23,389	72.4	2,846,991	--	73.0
2. Social Science	45.5	74.7	480,734	8,916	27.6	1,052,997	--	27.0

Source: Total current and capital expenditures obtained from Estimates of Expenditure, Jamaica, various years.

Table 4.1.11. Summary of Manpower and Financial Investments in Agricultural Education by Client Group, Jamaica 1973-74 and 1977-78.

II. Client Group Variable	Personnel (Person-years)		1973-74 Expenditures		Percent of 1973-74 Expenditures	1977-78 Expenditures		Percent of 1977-78 Expenditures
	1973-74	1978-79	Current	Capital		Current	Capital	
A. Urban Family	8.3	16.5	87,089	1,615	5.0	233,999	--	6.0
B. Landless (0-.9 acres)	47.8	66.3	505,119	9,368	29.0	935,997	--	24.0
C. Small (1-4.9 acres)	82.5	149.0	870,896	16,153	50.0	2,105,994	--	54.0
D. Medium (5-24.9 acres)	23.9	41.4	252,560	4,684	14.5	584,998	--	15.0
E. Medium-Large (25-99.9 acres)	1.7	2.2	17,418	323	1.0	31,200	--	0.8
F. Large (100 acres and over)	0.8	0.6	8,709	162	0.5	7,800	--	0.2
Totals	165.0	276.0	1,741,791	32,305	100.0	3,899,988	--	100.0

Table 4.1.12. Number of Students Completing Instructional Programs in Agriculture by Kind and Level of Institution, 1978-79.

Kind/Level of Institution	Number of Schools With Ag. Programs	Number of Agricultural Teachers	Number of Program Completions/ Graduates	Level of Preparation/Nature of Instructional Program in Agriculture
All-Age Schools (Grades 7-9) ^a	231	50	9,874 ^b	First-cycle secondary or 3 years of junior high school education; an average of 3 hrs. of agricultural instruction (gardening) per week.
Secondary: ^c				
New Secondary School	51	100	900	Instructional time in agriculture varies from school to school, but averages 80 mins./week for grades 7-9 and up to 15 hrs/week for students specializing in agriculture in grades 10 and 11.
Comprehensive High Schools	2	3	148	
Secondary High Schools	9	22		
Technical High Schools	4	3	154	
Vocational Schools	2	15	55	Approximately one-half of instructional time used for vocational agriculture.
Jamaica School of Agriculture	1	38	116	Diploma or Associate of Science Degree Level in Agriculture (or Home Economics)
Faculty of Agriculture, University of the West Indies	1	35	8 ^d	Degrees in Agriculture offered at the B.Sc., M.Sc., and Ph.D. levels.

^a At least four all-age schools were reported to offer agriculture through grade 11.

^b Estimated by multiplying the projected all-age, grade 9 enrollments for 1978-79 by .44 (proportion of all-age schools with school gardens). See Five-Year Education Plan (1978-1983), Ministry of Education, Jamaica, p. 215.

^c Numbers of secondary level schools with agriculture and numbers of agricultural teachers estimated from data provided by Agricultural Education Section, Ministry of Education; numbers of vocational school graduates, same source. Numbers of other secondary school graduates based on grade 11 enrollments in Agricultural Science and Agriculture during 1976-77. See Education Statistics, 1976-77, Ministry of Education, Jamaica, pp. 154, 156-157, 160-161.

^d This figure is for undergraduate (B.Sc.) degrees only. The number of Jamaicans who received graduate degrees in Agriculture during 1978-79 was not available from the Planning Unit, University of the West Indies, Mona.

actual instructional time used for agriculture and practical gardening was thought to average only about three hours per week. Some curricular guidelines in agricultural education for grades 7 and 8 were provided by the Ministry of Education to all-age and new secondary schools. Practical units in plant and animal science are stressed. Because only about one student in two continues formal education beyond grade 9, the all-age schools appear to be providing most of the formal education for students entering farming as an occupation. However, no follow-up study data were available on all-age school graduates.

Secondary-Level Schools. Much qualitative and quantitative variation exists among the approximately 68 agricultural education programs found in five different types of secondary schools. The Agricultural Education Section of the Ministry of Education has developed and disseminated a comprehensive curriculum and evaluation guide for agricultural instruction in grades 9, 10, and 11;^{1/} however, the degree to which all schools follow the guide could not be determined. Clearly, the estimated 1,257 individuals who completed some type of instructional program in agriculture during 1978-79 can not all be considered to have the same level of preparation for entry into an agricultural occupation. Those best prepared for employment appear to come from Knockalva, a vocational school. Technical high school graduates are probably next best prepared for agricultural employment, followed by new secondary school and comprehensive and secondary high school graduates. The latter probably have the best preparation for entry into higher levels

^{1/} Curriculum and Evaluation Guide, Grades 9, 10, and 11, Agriculture, Technical and Vocational Education, Ministry of Education, Jamaica, December 1977.

of agricultural education.

Agriculture as an occupation still does not enjoy much prestige among secondary school students, nor even among counselors and teachers in general. A Ministry of Education tracer study of the 1976 new secondary school graduates found that just prior to graduation only 6.3 percent of the students desired agricultural employment upon graduation, and 6.8 percent of the graduates had been enrolled in agriculture.^{1/} Nevertheless, six months after leaving school, 16.3 percent of the graduates were actually employed in agriculture, some of them self-employed. Greater efforts will need to be made to bridge the gap between the world of work -- where about 29 percent of the workers are engaged in agriculture -- and the new secondary schools, where only 7 percent of the students enroll in agriculture. This was the only follow-up study that could be found on the many former agricultural students from Jamaican secondary schools.

Jamaica School of Agriculture (JSA) Graduates. A total of 116 agricultural students graduated from JSA in December 1978 (96 with diplomas in Agricultural Science, 20 with Associate of Science in Agriculture degrees). This annual output represents a sharp drop in number of agricultural graduates compared to the two previous years (145 in 1976 and 147 in 1977) and an increase of only 29 percent over the annual output of JSA agriculturists in December, 1974.

No placement records were maintained on graduates of the Jamaica School of Agriculture; however, some estimates were obtained from JSA

^{1/} Keith Lowe and Yvonne Mahy, The New Secondary Graduates of 1976: Job Expectations on Leaving School and Occupations Six Months After, Research Section, Research Evaluation and Counseling Unit, Ministry of Education, Jamaica, 1978.

faculty members about the placement of their graduates over the past five years. Faculty consensus was that about 40 percent were employed by the Extension Service of the Ministry of Agriculture, 35 percent were teaching agriculture in an all-age or secondary level school, 10 percent were attending overseas colleges and universities, 8 percent were employed in the private sector, and about 7 percent were serving with non-Extension branches of the Ministry of Agriculture.

Teacher Preparation. The Government of Jamaica's Five-Year Education Plan (p. 190) projects a demand for 280 additional agricultural teachers by 1982-1983, 56 per year. Many, if not most, of the approximately 200 persons teaching agriculture in Jamaican schools during 1978-79 were not fully certified to teach agricultural subjects. JSA has the only teacher preparation program in agriculture on the island. Although only 35 JSA graduates completed the teacher preparation program in agriculture during 1978-79, this represented nearly a doubling in agricultural teacher output over the number prepared four years earlier (16 in 1975-76). Also, in addition to the 35 agricultural teachers, 11 graduates in 1978-79 were certified to teach Home Economics.

Higher Education. Approximately 85 Jamaican students were enrolled in undergraduate and graduate degree programs in agriculture at overseas universities in 1978-79. Data on the actual number of individuals graduating in agriculture in 1978-79 (i.e. output) were unavailable. However, information obtained from Planning Units in the Ministry of Education and the University of the West Indies (Mona campus) indicated enrollments of Jamaicans in colleges of agriculture at Canadian and U.S. universities have doubled over the past six years (12 in 1973-74 and 24

in 1978-79), while those enrolled in the UWI Faculty of Agriculture in Trinidad have held constant (61) for Academic Years 1973-74 and 1978-79. Despite constant enrollments at the Trinidad campus, the number of Jamaicans who actually received their B.Sc. degrees in Agriculture from UWI dropped from 19 to 8, respectively, for the two years compared. Most of the Jamaican students enrolled in agricultural programs in North America during the past five years have completed their degrees at Tuskegee Institute (50 percent in 1974-75, 80 percent in 1978-79).

Agricultural Manpower Supply and Demand. Looking at the annual output of trained Jamaican agriculturalists at institutions (both domestically and overseas) presents only a portion of the agricultural manpower picture. Some college graduates fail to pursue careers in agriculture in Jamaica, and some elect not to return to their island home. Turnover is high among teachers of agriculture, perhaps as much as 50 percent per annum, and each year approximately 20 percent of the Extension Service personnel leave their jobs. At these rates of turnover, JSA's annual output of agriculture graduates is sufficient to maintain the current number of trained personnel in the agricultural sector and to increment the staff holding diploma's by 20 workers. Without a reduction in the teacher turnover rate, a trebling of certified agricultural teacher output may be needed in order to staff more schools with certified agricultural teachers. More precise analysis of supply and demand could be achieved with greater use of agricultural graduate follow-up studies. It is difficult to evaluate an institution's educational program without following up the placement and progress of its graduates.

Linkages to Other Organizations

Agricultural education specialists in the Ministry of Education and selected agricultural instructors and/or administrators at the Jamaica School of Agriculture and five secondary level institutions (1 vocational, 2 technical, and 2 high schools) were asked to describe the nature, level, and frequency of their contacts over the past five years with various external organizations. Examples of the kinds of organizations identified and frequency of contact are presented in Table 4.1.13. The nature and level of those contacts are described in the following paragraphs.

Agricultural Education Section, Ministry of Education. Significant coordination is effected between the Ministry of Education and various units of the Ministry of Agriculture through the MINED agricultural education officers. The two ministries are jointly involved in the planning of school instructional curricula, farms, and gardens. Extension bulletins produced by the Agricultural Information Service (MINAG) are regularly made available on a limited basis to the Ministry of Education. The Agricultural Education Section, in turn, sends copies of the bulletins to schools -- with priority given to the "[agriculturally] more progressive" institutions. During 1978, the Plant Production Unit in MINAG provided approximately 20,000 fruit trees to schools. Those seedlings were distributed through parish councils in cooperation with the Ministry of Education.

Close informal contacts were also maintained between the Agricultural Education Section and the Jamaica School of Agriculture with regard to articulation of secondary and tertiary level agricultural

Table 4.1.13. Some Informal (Operational) Linkages of the Agricultural Education Subsystem.

Institutions With Agricultural Education Components	Kinds of External Institutions to Which Informally Linked																							
	Alcan Jamaica Development Corp.	All-Age Schools	Bureau of Standards	Canadian International Development Agency (CIDA)	Farmer Groups	Foreign Universities	High Schools and Comprehensive Schools	Inter-American Institute of Agricultural Sciences	Jamaica Agricultural Institute of Jamaica School of Agriculture	Ministry of Education	Ministry of Agriculture	Ministry of Parliament Affairs	Ministry of Youth and Sports	Practical Training Schools	Statutory (Commodity) Boards	Technical High Schools	U.S. Peace Corps	University of the West Indies	Vocational Schools					
Agricultural Education Section Ministry of Education				C			X	B				A	A	A		X	C	B			B	C	C	B
Jamaica School of Agriculture	B	B	B	B	C	A	A	B	B	A		A	A	B	A		D	D	B	B	D	A	B	
Comprehensive and High Schools					B		X			B		X			X		X		X		B	B	X	
Technical Schools		B				B				X	B	X	B		B		X	B	X	X	C		X	
Vocational Schools						X				X		X			X		X		X		D			
New Secondary Schools						X				X		X			X		X		X					
All-Age Schools						X				X		X			X		X		X					

Note: This information was obtained through personal interviews with selected agricultural teachers and administrators and is considered to be illustrative (not comprehensive) of information linkages within the education subsystem.

Frequency of Contact Scale: A = Frequent; 4 times or more per year
 B = Occasional; 1-3 times per year

C = Infrequent; less than once per year
 X = Linkages assumed; frequency unknown

curricula and arranging for and grading agricultural examinations. The senior MINED agricultural education officers is also a JSA faculty member. This individual and/or his staff of regional education officers visits each technical, vocational, or high school agricultural program several times each year to supervise grant expenditures and respond to requests for technical assistance. Agricultural programs at new secondary schools are checked once or twice per year; however, the more numerous all-age schools are contacted less frequently.

Other Ministry of Education linkages include those with the Jamaica Agricultural Society -- attending its annual meeting and working with JAS sponsored competitive events in agriculture -- and participating with representatives of the Jamaica School of Agriculture, the Ministry of Agriculture, University of the West Indies, and various private agricultural entities which are represented on the National Agricultural Curriculum Committee. The Coffee Industry Board provides schools with plots of land for demonstration purposes under the auspices of MINED.

The Jamaica School of Agriculture (JSA). JSA, like the hub of a wheel, is informally linked through its graduates and day-to-day operations to nearly every major agricultural organization in Jamaica. A few of those "spokes" (linkages) are described below.

The Jamaica School of Agriculture is the nation's primary source of agricultural teachers and extension personnel; therefore, informal linkages between JSA faculty members and their former students are quite natural and assured. The Agricultural Education Department has built linkages with schools by placing its student teachers in various new secondary, technical, vocational, and high schools for completion of semester-long practice teaching internships and by conducting summer

courses in cooperation with the Ministry of Education for practicing teachers seeking certification as "trained" teachers of agriculture. Meanwhile, agricultural students and staffs of secondary level and all-age schools and practical training centers (MINAG) reciprocate by using JSA as a field trip site and by involving JSA faculty as resource persons for their schools' career guidance activities.

The School's faculty is also involved in numerous service and public relations activities such as offering evening classes to continuing education students on various agricultural and home economics topics; conducting practical short courses in farm mechanics to agricultural students enrolled in the University of the West Indies (Trinidad campus); providing orientation sessions for U.S. Peace Corps volunteers; offering a Dairy Practical Program for agricultural students at Munro College; preparing and marking examinations for secondary school students on specialized agricultural topics; and conducting demonstrations for farmer groups. JSA students and staff often participated in exhibitions such as the Jamaica Horticultural Society Show and the Denbigh Agricultural Show, and provide voluntary services to 4-H clubs and residents of new government housing areas (gardening assistance). Also, the School and the Ministry of Agriculture co-sponsor in-service training programs for Extension Service staff and conferences for various farmer groups.

The School's linkages are further enhanced by representatives of various firms (Jamaica Bauxite Institute, Cornwall Dairies, Alcan Jamaica Company) and organizations (Jamaica Agricultural Society, Old Student Association, National Planning Agency, Agricultural Development Corporation) serving as members of the JSA Board of Governors. Furthermore, several organizations -- for example, statutory (commodity)

boards, the Cooperative Development Agency, and the Bureau of Standards -- provide instructional materials, resource personnel, and field trip sites for the School.

JSA linkages with the international community include those with foreign universities (technical assistance, transcript requests); Inter-American Institute of Agricultural Sciences (IICA publications); U.S. Peace Corps (two P.C. volunteers have served as JSA instructors over the past five years); and the Canadian International Development Agency (CIDA has provided funding for students from the Eastern Caribbean).

Secondary Level Institutions. Linkages between the various kinds of secondary level schools varies greatly from institution to institution, depending on school location, tenure of agricultural teaching staff, and kind of school. In general, linkages with the Ministry of Education and the Ministry of Agriculture are both strong, with frequent contact reported between teachers and ministerial officers. Agricultural education officers from the Ministry of Education usually contact schools regarding curriculum matters, while contacts with the Ministry of Agriculture are often with Extension Service officers. Regional MINAG officers serve on the Agricultural Committees of some schools offering instruction in agriculture.

Schools reported frequent contact with JSA, usually as a field trip site, but also for certification of secondary school students in the operation of specialized agricultural equipment (milking, heavy tillage, etc.), and for teacher recruitment. Some technical and secondary high schools maintain linkages with other kinds of schools in their geographical area (new secondary and all-age) through occasional presentations of agricultural topics by their teachers. Several agricultural teachers

serve as 4-H Club leaders and some serve as presidents of local chapters of the Jamaica Agricultural Society. However, it appears that in some schools contacts between local farmers and agricultural teachers, particularly younger (newer) instructors, are quite limited.

Linkages Summarized. A summary of the adequacy of the various teaching subsystem linkages with regard to client groups is shown in Table 4.1.14.

Table 4.1.14. Teaching Subsystem Linkages to Client Groups.

Client Group	<u>Faculty to Client Group</u>		<u>Client Group to Faculty</u>	
	Adequate	Inadequate	Adequate	Inadequate
Students		X ^a	X	
Policy Makers	X		X	
Farmers		X ^b		X ^b

^a Inadequate due to lack of follow-up of former students, and little involvement of teaching subsystem in meeting the in-service needs of its graduates who are practicing agriculturalists.

^b Much more involvement is needed by the teaching subsystem in interfacing the instructional curriculum with the real world of production agriculture.

Incentives Provided to Personnel

Information regarding incentives in the agricultural education subsystem was obtained through structured interviews with agricultural teachers and administrators in five selected schools, with department heads at the Jamaica School of Agriculture, and from the Finance/Budget Office, Ministry of Education. Teacher pay scales are established by

the Ministry of Education.

Salaries. Since the adequacy of salaries is a relative question, interviewees were asked how faculty salaries at their institution compared with those offered by other agencies, groups, or occupations that seek personnel with comparable education and experience. Two-thirds of the respondents indicated the salaries paid to agricultural teachers were lower than those paid to Extension Officers and other agriculturalists. The remaining one-third indicated agricultural teachers were paid the same or slightly more than teachers of other subject matter areas, but indicated Extension Officers received government loans for purchasing personal automobiles. With the shortage of transportation, the auto loan was viewed as an attractive perquisite. The ranges of salaries paid to agricultural teachers at secondary level schools and at JSA are presented in Table 4.1.15.

Most agricultural teachers who had recently left their school teaching positions reportedly did so in order to obtain better paying jobs in the private sector or with the Ministry of Agriculture. Others left to pursue further education. Those faculty members leaving JSA were reported to have left primarily for teaching and administrative positions offering higher salaries and better working conditions. However, unlike secondary school agricultural teachers, those leaving JSA tended to stay within the agricultural teaching subsystem.

Program Support. With one exception, all instructors interviewed indicated they failed to receive adequate equipment and instructional supplies. Several respondents felt many agricultural teachers left teaching because of unsatisfactory working conditions, physical and otherwise. Many teachers expressed considerable frustration at the

Table 4.1.15. Pay Scales for Agricultural Instructors in Jamaica (Effective July 1, 1978).

Classification		Lowest Salary	Annual Increment	Highest Salary
Agricultural Teachers at the Secondary School Level	Specialist II (usually Diploma in Agriculture without teaching certificate)	J\$ 4,780	180	J\$ 6,760
	Specialist I (usually Dipl. in Agriculture with teaching cert.)	6,160	300	7,860
	Graduates Pre-trained (regular degree without teaching cert.)	6,160	240	8,320
	Graduates Pre-trained (honors degree without teaching cert.)	6,640	240	8,800
Jamaica School of Agriculture	Lecturer	6,520	300	9,820
	Senior Lecturer	8,720	360	10,540
	Principal Lecturer or Head of Department, Grade I	10,000	420	11,260
	Head of Department, Grade II	10,660	420	11,920
	Vice-Principal	11,260	480	13,180
	Principal	13,780	480	15,700

Source: Finance/Budget Office, Ministry of Education.

unavailability of transportation, supplies, and adequate physical plant to effectively discharge their professional responsibilities. Of the four incentive categories, program support is viewed by the investigator as the weakest link.

Promotion Structure. Length of service or seniority was the most common criterion reported for promotion of teachers. Although little evidence was found to indicate that merit or productivity were significant factors in the promotion structure for teachers, those factors were reported to play some role in the promotion of administrators.

Professional Development. The perceptions of JSA faculty and secondary level agricultural teachers differ regarding the extent to which they are encouraged to attend in-service workshops, conferences, and seminars. Most JSA faculty members feel that they are encouraged to participate in professional development activities, most of the secondary agricultural teachers who were interviewed did not. However, most teachers at both educational levels reported that paid sabbatical leaves of four months duration were available for professional self-improvement once every seven years.

Some Suggested Incentives. Ideas for retaining more good agricultural teachers in teaching were sought from respondents. Those suggested by secondary school teachers included better salaries, more scholarships (for continuing their education), better equipment, opportunities to earn an agricultural income in addition to teaching salary (i.e. some land to farm on the side), more opportunities for self-improvement, and being made to feel a part of a successful educational program. JSA respondents focused on housing. Also suggested were reduced prices for farm products, and housing at minimum rentals.

Adequacy of Staffing

A critical shortage of trained agricultural manpower exists in Jamaica. The agricultural education subsystem, with the Jamaica School of Agriculture as its keystone, currently lacks both the qualitative and the quantitative capacity or critical mass to adequately prepare agriculturalists -- especially agricultural teachers and extension personnel -- for their catalytic roles as interpreters, multipliers, and disseminators of agricultural information.

The number of professional personnel in the agricultural education subsystem in Jamaica during Academic Year 1978-79, by highest academic attainment (skill level) and institutional level, are shown in Table 4.1.16. Only one person on-island in Jamaica could be identified with a Ph.D. degree in Agriculture within the education subsystem -- the Principal of JSA. The number of practicing professionals with masters degrees in Agriculture on faculties of educational institutions could not be fully determined -- twenty were estimated, but only six were identified in Jamaica (also six were on the Faculty of Agriculture, UWI/Trinidad). All six -- plus two with masters degrees in Home Economics -- were on the JSA faculty. Of this group, two were vice-principals (one has since retired) and three were department heads, leaving only three of the eight to serve full-time as instructors. The number of professional personnel on the JSA faculty, by degree and discipline, is presented in Table 4.1.17.

Only four of the seven academic departments at JSA has faculties which, numerically, approach a critical mass. Those include Agronomy, Animal Science, and Natural Science, each with six faculty members, and

Table 4.1.16. Critical Mass: Estimated Number of Professional Personnel in the Agricultural Education Subsystem in Jamaica by Skill Level, 1978-79.

Functional Level Agricultural Education ^a	Skill Level (Highest Academic Attainment)							Total
	Ph.D.	M.A./M.S.	B.A./B.S.	A.S.	Diploma With Teach. Cert.	Diploma Without Teach. Cert.	Less Than Diploma	
University of the West Indies (Faculty of Agriculture)	24 ^b	6	5	-	-	-	-	35
Jamaica School of Agriculture	1	11	13	6	5	-	2	38
Secondary Level Schools	-	3	27 ^c	10	35	35	43	153
All-Age Schools	-	-	5 ^d	5	5	5	30	50
TOTALS	25	20	50 ^e	21	45	40	75	276 ^e

^a The four specialists in the Agricultural Education Section of the Ministry of Education were omitted from this table.

^b All 24 Ph.D. holders were located at the St. Augustine campus in Trinidad.

^c Only seven were estimated to have completed B.S. degrees in Agriculture.

^d The five baccalaureate degrees were thought to be in disciplines other than Agriculture.

^e Including at least 20 with baccalaureate degrees in disciplines other than Agriculture.

Table 4.1.17. Number of Professional Personnel in the Jamaica School of Agriculture by Discipline and Skill Level, 1978-79.

Discipline	Skill Level (Highest Academic Attainment)						Total
	Ph.D.	M.A./M.S.	B.A./B.S.	A.S.	Diploma	Less Than Diploma	
Agricultural Education		3*					3
Agricultural Engineering				1		2	3
Animal Science		1	2	2	1		6
Art					1		1
Botany			2				2
Chemistry			2				2
Crop Science		1	1	1	2		5
Economics/History		2					2
English			2				2
Home Economics		2	1	2	1		6
Horticulture			1				1
Soil Science	1*						1
Plant Pathology		1*					1
Physics/Mathematics			2				2
Psychology		1					1
TOTALS	1	11	13	6	5	2	38

* One administrator included in total.

Home Economics with seven. Although the Agricultural Education Department has two instructors with masters degrees in Agricultural Education, its faculty is too divergent in training (two in English, one in Psychology) to constitute a critical mass. The Agricultural Economics and Agricultural Engineering faculties are actually too small to be considered viable departments. None of the seven departments approaches a critical mass in terms of faculty qualifications.

Jamaica has a nucleus of perhaps 40 agricultural teachers at the secondary and all-age level who have completed some, if not all, of the teacher certification requirements. However, this group has no professional organization, has a high turnover rate, and is likely to remain fragmented indefinitely because of communication and transportation problems.

Because of the lack of institutional capacity at the Jamaica School of Agriculture and the limited potential of the Faculty of Agriculture in Trinidad to prepare agricultural teachers and extension personnel, Jamaica must -- at least for the next decade -- rely on overseas institutions other than the University of the West Indies to prepare (or provide) the quantity and quality of baccalaureate-level agriculturalists it will need during the 1980's. By building up the professional staff and institutional capacity of JSA during the 1980's, Jamaica could very well develop the critical mass of agriculturalists needed to sustain its agricultural growth and productivity during the 1990's.

RESEARCH

Introduction

Agricultural research in Jamaica had its formal beginning with the appointment in 1908 of Mr. H. H. Cousins as the first Director of Agriculture. Mr. Cousins served in this position until 1932, and was actively engaged in animal breeding experiments. Initial work was primarily with dairy cattle, but included experiments with sheep, pigs, and poultry as well.

Experiments with mangoes began in 1914 and with pineapples in 1921. The acquisition in 1921 of Grove Place, a 1200 acre farm, to be used as a government research station gave further impetus to the experimental work with dairy cattle, including Jersey, Guernsey, Red Poll, Brahman, Brown Swiss, and various crosses.

In 1932, Mr. T. P. Lecky succeeded Mr. Cousins as the leader of agricultural research activities, and he concentrated his work on developing the Hope Jersey, a dairy animal suited to tropical conditions.

During the 1930's, experiments were conducted with corn, Irish potatoes, pulses, and citrus crops, and in 1946 pasture research was initiated. Early pasture introductions included Guinea grass, napier, Guatemala grass, African star grass, and a number of legumes. In 1955, experimental work was begun with pangola grass.

Ministry of Agriculture research on bananas began at the Orange River station in 1941 in connection with the leaf spot disease, and trials were also initiated with cacao.

Special commodity boards were created for sugar, bananas, coffee, coconuts, and cacao in the 1940's and 50's, and for tobacco in 1967. Most of these boards have carried out both research and extension activities for their particular commodity groups.

Over the years, agricultural research in Jamaica has become fragmented among a number of different government and quasi-government institutions. In recent years, studies by various international agencies (particularly the World Bank, the Inter-American Development Bank, and the Food and Agriculture Organization) have pointed out the need for restructuring and reorganization of the research system in order to reduce duplication of effort, focus on priority problems, and provide more efficient and effective linkages between research and extension and ultimately with farm clientele groups.

Among these recent studies was report by a 1974 joint FAO/IBRD Cooperative Program mission which visited Jamaica for the purpose of identifying a rural development project. Growing out of this mission's study was the recognition (and recommendation) that the program of research (and extension) of the Ministry of Agriculture needed strengthening and possibly restructuring. Subsequently, an FAO/IDB team conducted a reconnaissance of Jamaica's agricultural research structure, and prepared a report entitled, Jamaica Agricultural Research Reconnaissance Mission Report (Washington, D.C., February, 1976). A full mission followup to this study produced an in-depth analysis of the needed reorganization and provided a detailed set of procedures and

recommendations to be followed in implementing the proposed reorganization. This FAO/IDB report entitled, Jamaica Agricultural Research (Washington, D.C., December 1976) appeared in five volumes. The Jamaican Government has accepted, with some modifications, most of the recommendations contained in this latter study and it thus represents the operating document for the reorganization that Jamaican agricultural research is currently undergoing.

In order to assist the Jamaican Government in its reorganization efforts, an IDB loan project (Agricultural Research Project) is in the process of finalization. Under this project, which will have a total cost of US\$10.9 million, the IDB will provide a US\$6.4 million and the Jamaican Government will provide the balance.

At the present time, some of the recommendations of the FAO/IDB mission have already been implemented, others are in process of implementation, and others are still being discussed. Thus, organizational structure, staffing patterns, and budgets are not yet firm in all areas of the research program. Nevertheless, the findings and recommendations of the FAO/IDB mission have understandably strongly influenced the recommendations section of the present study.^{1/}

Reorganization Plans.^{2/} "The basic objective of the [reorganization] is to provide the institutional framework and physical facilities

^{1/} A good summary discussion of research is provided in G. Barker, A. Wahab, and L. A. Bell, Agricultural Research in Jamaica (Inter-American Institute of Agricultural Sciences: Kingston, 1977). This publication has been drawn upon freely in the present study.

^{2/} This section quotes directly from a paper entitled, "A New Approach to Agricultural Research," prepared and presented by Dr. Karl E. Wellington at a Ministry of Agriculture seminar held June 6, 1979, in Kingston. Dr. Wellington has been named Director of Research and Development under the new organization.

necessary for the...conduct of agricultural research services, so that applied research, together with complementary extension programmes, can be more appropriately geared to increased agricultural food production in Jamaica."

"In accomplishment of this objective, and considering the need for more effective utilization of research resources, the following targets have been set.

- i. The progressive centralization of policy decisions with respect to agricultural research into a single entity which will be the Research and Development Department of the Ministry of Agriculture.
- ii. The widening of research activities at regional research stations and substations.
- iii. The strengthening of planning and technical capabilities in agricultural research by a) the identification of food crops which affect small and medium farm units, and planning research programmes related to these crops; b) the provision of research specialists to assist in the planning of applied research; c) the training of local research officers.
- iv. The coordination of research work and farm extension services through local specialists who will serve as liaison between research and extension staff at regional stations to assist in the transfer of technology to the farmer."

Under the IDB loan-financed reorganization and development program, the research and extension activities of a number of quasi-independent statutory boards will be brought, within the next four years, under the more direct control of the Ministry of Agriculture. The Southern

Regional Research Station at Bodles will be strengthened substantially, and a Western Regional Research Station will be established at Montpelier.

Current Structure of the National
Research System

Agricultural research in Jamaica, along with agricultural production, represents a dual structure: 1) the export crops (principally bananas, coconuts, and sugar, and to a lesser extent coffee, cacao, and tobacco), and 2) the domestically consumed crops and livestock.

Research on the export crops is conducted by a group of commodity boards which legally fall under the purview of the Ministry of Agriculture, but which over the years have gained a large degree of both budgetary and policy making autonomy. In terms of research, only the Banana Board, the Coconut Industry Board, and the Sugar Industry Research Institute are carrying out significant levels of activity. Table 4.2.1 lists the statutory bodies which are legally under the Ministry of Agriculture.

Table 4.2.1. Statutory Bodies Under the Ministry of Agriculture.

Statutory Body	Year Established
Banana Board	1955
Coffee Industry Board	1948
Coconut Industry Board	1959
Cocoa Industry Board	1957
Tobacco Industry Control Authority	1967
Sugar Industry Research Institute	1942
Agricultural Development Corporation	1952

In order to comprehend the structure of Jamaican agricultural research, it is necessary to know something about the role and function of each of these statutory bodies; thus, a brief profile of their research activities follows:

Statutory Boards Under the Ministry of Agriculture

Banana Board. Professional and technical research and support staff (1978) included three Ph.D.s, one M.S., seven B.S., eight diploma, and eight secondary level graduates. The Board was created to service the export market, and has neither the experience nor the orientation to work with the domestic market. The Board is the sole exporter of Jamaican bananas, which it purchases from individual growers and private companies. Prior to 1976, the Board received no research funds from the Ministry of Agriculture, but since that time all of its research funds have come from the Ministry. A levy is collected from growers at the boxing plant and historically this has provided sufficient funds for the operation of the Board. As banana exports have declined, however, revenues have fallen and currently the Board is not making a profit. The deficit is being made up from Government revenues.

Major research efforts are devoted to plant protection and soil fertility, which together accounted in 1978 for slightly over 50 percent of the research budget and for all four researchers who hold post-graduate degrees. There are no researchers with advanced training working in such vital areas as varietal improvement, cultural practices, irrigation and water management, packaging and processing, cropping systems, or economic analysis.

The Board has no research land of its own, but is allocated land on some Ministry of Agriculture research stations. It is anticipated that under the proposed reorganization all Banana Board research personnel and activities will be transferred to the Ministry of Agriculture.

The yield gap between "good" commercial banana plantations (10-12 tons per acre per year), the "typical" commercial farm (7-8 tons per acre), and the "small" farmer (2-3 tons per acre) is substantial. In general, it is felt that sufficient research information on improved varieties, cultural practices, and modern inputs exists to significantly increase average yields. However, the shortages of inputs and the difficulties in reaching the many small farmers and encouraging adoption of improved practices and recommended varieties (Valery and Giant Cavendish) impose significant constraints to increased production.

There is also a small banana breeding facility (separate from the research department of the Board) which is located in Jamaica and is cooperative among Jamaica/the Windward Islands/Trinidad. It has a British Director and offices in the Banana Board. This organization has developed several varieties which are disease resistant and of good eating quality, but do not possess good shipping quality. The expense of the banana breeding program is currently being discussed, and it has been suggested that steps may be taken to "internationalize" the breeding work with the participation of a number of other banana producing countries.

Coffee Industry Board. Very little research is conducted by the Coffee Board. A few trials are being carried out with agricultural chemicals, plus some variety trials, and some work with "resuscitation" of older trees through heavy pruning. The Government provides no

budgetary support to the Board. Its funds are derived from profits on marketing activities through 18 coffee cooperatives. The Board hasn't a budget, trained personnel, or the responsibility for research.

Given the relatively small scale of Jamaican coffee production, primary reliance is placed upon research recommendations developed in Costa Rica, Brazil, Nicaragua, and Mexico, and channeled through the Inter-American Institute of Agricultural Sciences.

As in the case of bananas, the availability of production inputs and the low adoption rate of recommendations is viewed as a major constraint to increased production — particularly among the small farms. Coffee in Jamaica is generally intercropped rather than grown as a pure stand. Thus, though per tree yields are comparable to Central American yields, the plant population is only about 50 percent as high. Average national production is about 300 pounds per acre, but the farms run by the Coffee Board and other large private farms average approximately 1,000 pounds per acre. Some very good farms on fertile soils are producing up to 3,000 pounds per acre, while small farmers are producing only 100-150 pounds per acre. It is generally felt that the technical knowledge base exists to significantly increase yields.

Coconut Industry Board. The professional and technical researchers and support staff of the Coconut Board include (1978) two M.S., two B.S., three diploma holders, and ten secondary school graduates. Major research activity is devoted to varietal improvement, which in 1978 received approximately 44 percent of the current expenditure budget, followed by soils and fertility work with 26 percent of the budget. The Board uses land on the experiment stations of the Ministry of Agriculture to conduct its research. The agronomy section conducts research on

soil fertility problems, intercropping, weed control, spacing, and soil management, and a plant breeder works on varietal introduction, evaluation, and some hybridizing. The Board's small chemistry laboratory runs leaf sample analyses as well as analyses of coconuts and copra. The main activities appear to be in seed production and seedling distribution of the Malayan Dwarf (which shows resistance to Lethal Yellowing) as a replacement for the highly susceptible Jamaica Tall variety. An estimated 300,000 Jamaica Tall trees are being lost annually to the disease.

The Board receives no direct funding from the Government for staffing, and its income is derived primarily from a cess collected by SEPROD (the coconut purchasing agency) which is owned by the Board. Some funds are provided by the Government for special programs such as the Lethal Yellowing Program, and funds have been requested, but so far not received for the replanting program.

The Coconut Board does not expect that its activities will be brought under the direct control of the Ministry of Agriculture in the reorganization.

Sugar Industry Research Institute. This is the research arm of the most independent of the statutory boards under the Ministry of Agriculture. Its headquarters, laboratories, and greenhouse facilities are located near Mandeville -- specifically situated far from the sugar cane growing areas in order to facilitate quarantine and evaluation of varieties introduced from abroad. The Institute has no experimental cane lands of its own for research purposes, and must rely on cooperative arrangements with sugar estates and farms in the conduct of field trials.

The professional and technical researchers and support staff include (1978) one Ph.D., four M.S., five B.S., one A.S. (Associate Degree), two diplomas, and seventeen secondary school graduates. Major emphasis is placed upon soils and fertility research and varietal improvement. A fairly broad spectrum of research activity is carried out, with at least one university trained person working in each of the following areas: varietal improvement, soils and fertility, plant protection, cultural practices, irrigation and water management, economics, plant physiology, and harvesting and transportation research.

Production data are collected annually by the Institute in its "Cane Survey," and yields, volume of inputs, and other data are computerized. A 100 percent sample is run on the estates, plus approximately 20 percent of individual farms (representing about 40 percent of the individual farmer-grown cane area). The Institute employs on its staff a systems analyst plus an agricultural engineer trained in operations research. Simulation models have been developed to increase the efficiency of cane harvest and transport, with the objective of getting cane to the mill sooner after harvest and thus with a higher sugar content.

The Institute laboratory is well equipped, and does tissue analysis (principally N-P-K) of about one-third of the cane fields each year (representing approximately 85 percent of the cane produced). Extension workers employed by the Sugar Board help collect tissue samples from small producers, and large farmers and estates send in their samples for analysis. Cane breeding work is carried out principally in Barbados, financed jointly by several Caribbean countries. Barbados makes crosses and sends 40,000 seedlings to Jamaica each year. Researchers at the

Institute make selections from among these (about 10 percent each year), and it takes approximately eight to ten years to develop and release a new variety. Germ plasm exchanges are also made with USDA, Cuba, and other countries. The Institute's facilities (including offices, laboratory, library, plant quarantine, greenhouses, etc.) are quite good. The Institute also appears reasonably effective in disseminating recommendations to its clientele.

Cocoa Industry Board. The Cocoa Board does not engage in research activities. This responsibility is assigned to the Ministry of Agriculture. The Board's responsibilities are to: 1) regulate and promote the development of the industry, 2) arrange for purchase/processing, and marketing (both domestic and export), 3) advise the Minister of Agriculture on factors affecting the cocoa industry.

The Board manages four fermentaries which handle the bulk of the cocoa production. Until 1977, the Board had an active extension service with five field men and 43 headmen. As a part of the reorganization, these activities were absorbed by the Ministry of Agriculture.

The Board is currently planting its own plantations. Well-managed cocoa farms can produce 600 pounds of dry cocoa per acre, but the average for the island is less than 200 pounds per acre. There are 24,000 registered cocoa farmers, the majority of whom (17,973) operate cocoa farms of two acres or less.

Agricultural Development Corporation. The Corporation has no formal research arm, but does carry out a small amount of applied research designed to modify production systems. Its original charge was to activate, stimulate, and facilitate agricultural development -- especially to place on a commercial basis the research recommendations

of the Ministry of Agriculture and determine if they are viable. ADC provides land and facilities for experimental work by Ministry of Agriculture personnel rather than carrying out an active research program itself.

Currently, the ADC serves as "custodian" for some 20,000 acres of land (much of it presumably destined for allocation to farmers) and some 11,000-12,000 head of cattle. The ADC has major responsibility for small livestock (pigs, sheep, and goats) and is receiving assistance from CIDA (Canada) in developing this area. It operates a national breeding program for swine (Large White, Landrace, and Hampshire) and supplies approximately 20 percent of the replacement pure-bred females or cross-breeds used by commercial herds. ADC also conducts a swine performance testing program, and the national carcass testing program; it grades hogs at three main slaughter plants in a program initiated in 1978. Although farmers are not currently paid on the basis of grades, this is an objective of the program. ADC also has a program to multiply the national sheep and goat herd, which has remained relatively static as imports have risen, and is working on a sheep disease prevention program. Some research with imported goat breeds and cross-breeding is underway. Wool production activities are being carried out with technical assistance from Virginia (USA), and there are plans for developmental work with dairy goats with the objective of increasing human nutritional levels in rural areas (particularly among nursing mothers and young children).

Tobacco Industry Control Authority. The research unit of the Tobacco Authority is located on five acres of irrigated land near Old Harbour, and has responsibility for plant breeding, plant protection,

cultural practices, and nutrition research. It was established in 1970 as a result of Dutch Government assistance in reviving Jamaica's cigar tobacco industry. Although the Dutch aid program ended in 1975, the research program has continued along the lines established at that time. Technical assistance is presently being provided via the North Carolina State University (USA) and the Carreras Company.

Tobacco production involves a very limited number of growers (less than 50), all of whom are located in the parishes of Clarendon and St. Catherine. Funding is provided for the research program both by the Government and by the Tobacco Authority, and it is not currently anticipated by the TICA that these research activities will be absorbed by the Ministry of Agriculture.

In 1978, the research budget totaled J\$19,000 and the professional and technical research and support staff included: one B.S. degree and one diploma holder.

Other Statutory Boards

Two additional statutory boards, which engage to some extent in agriculturally related research, but which are not attached to the Ministry of Agriculture are: The Scientific Research Council (Ministry of Finance and Planning) and the Jamaican Industrial Development Corporation (Ministry of Industry and Commerce).

Scientific Research Council. Established in 1960, the technical staff is heavily weighted towards chemists. The Agro-Industry Division conducts research on the economic utilization of agricultural crops and by-products including primarily: 1) oil seed crops (sunflower and castor bean), 2) essential oils and spices, 3) by-products of the sugar

industry. The Food Science and Nutrition Division is conducting research on the development of composite flours (imported wheat flour plus domestically produced cassava flour) and enriched foods, and is assessing the storage and table qualities of different varieties of Irish potatoes, cassava, and guava. In 1978, the research budget for these two Divisions totaled J\$219,000. Scientific and professional personnel and support staff included two Ph.D.s, six M.S., seven B.S., and 12 technicians with less than a B.S. degree.

Jamaican Industrial Development Corporation. Established in 1952 for the purpose of encouraging and facilitating industrial development, the corporation has conducted feasibility studies, market research and evaluation, and has provided advice on industrial plant location and conducted some training activities. Its Food Technology Institute initially focused upon the development of new food products from local raw materials and has a well-equipped pilot plant and staff. Current emphasis is upon providing technical assistance to processors and potential processors. Information was not obtained directly from this organization, and its input to agricultural research does not appear in the quantitative data included in this study.

Other Research Organizations

There are also several other organizations that are engaged in agricultural research activities, including the Caribbean Agricultural Research and Development Institute (CARDI), the Storage and Infestation Division of the Ministry of Industry and Commerce, and the University of the West Indies (Mona Campus), Pioneer Hi-Bred Inc., and Alcan Jamaica Ltd.

Caribbean Agricultural Research and Development Institute. A predecessor organization, the Regional Research Centre (RRC) was established by the United Kingdom in 1955 in Trinidad as a unit of the Imperial College of Tropical Agriculture. When the U.K. phased out financial support for the RRC in 1975, CARDI was created under Articles of Agreement signed by the governments of the Caribbean Community. Headquartered in Trinidad, CARDI services twelve Caribbean member countries (Antigua, St. Kitts-Nevis-Anguilla, Barbados, Guyana, St. Lucia, Belize, Jamaica, St. Vincent, Dominica, Montserrat, Trinidad, and Tobago).

The Jamaica Unit of CARDI, housed on the grounds of the University of the West Indies (Mona Campus), was formally established in 1974. As of 1978, professional and technical research staff included two M.S., five B.S., and seven with less than a B.S. degree. The research budget for 1978 was J\$120,000.

Major activities include participation in the Ministry of Agriculture Seed Farm work; research on cropping systems of hill farms; introduction and evaluation trials of peanuts, onions, cowpeas, beans; and intercropping trials with sugar cane.

Administratively, CARDI expects and desires to become fully integrated into the Ministry of Agriculture. Approximately one-third of the core budget of CARDI is provided by the Government of Jamaica. Due to lack of coordination, the resources of CARDI are not currently being utilized to their full capacity by the Ministry of Agriculture.

Storage and Infestation Division. This Division of the Ministry of Industry and Commerce carries out a research program which includes: rodent control and pesticide evaluation, warehouse storage structures

and facilities, and storage and storage loss prevention for various food crops. Such research has been conducted with a large number of crops, including yams, Irish and sweet potatoes, cassava, various legumes, rice, breadfruit, plantain, and selected vegetable crops.

University of the West Indies (Mona Campus). Some agricultural research activities are carried out principally by the departments of Botany, Chemistry, and Zoology, all of which were established in 1948. The Botany Department works with the Ministry of Agriculture in the areas of plant pathology, crop production, plant physiology, plant breeding, and ecology. The Chemistry Department cooperates with the Sugar Industry Research Institute in research on sugar and rum production, and with the Ministry of Agriculture in studies of pimento and yams. The Zoology Department cooperates with the Ministry of Agriculture in pelagic fish studies and oyster culture as well as conducting environmental impact studies. Estimates of scientific man years employed in agricultural research, and supporting budgets, were not provided by the University.

~~The University of the West Indies (Trinidad)~~ through its Faculty of ~~--- --~~ Agriculture conducts a substantial agricultural research program, much of which is applicable to Jamaica.

Pioneer Hi-Bred International Inc. The parent firm of this private company is based in the United States, and has operated in Jamaica since 1958. Originally established as a location for winter corn and sorghum breeding for the U.S., it became (in 1964) a tropical corn and sorghum breeding station for both Jamaica and the U.S. Since 1976, the program has concentrated on sorghum to the exclusion of corn work. Beginning in 1974, a small soybean testing program has been conducted in cooperation

with INTSOY (University of Illinois). The station has 120 acres of land, a seed processing plant, a research cold room facility, and cold storage for up to 9,000 bushels of grain.

Alcan Jamaica Ltd. Research activities of this private firm focus upon reclamation, restoration, and economic utilization of mined out bauxite lands. All of the companies engaged in bauxite mining in Jamaica are contributing financially to this program. Activities have included pasture and livestock development, as well as crop production research. The Alcan herd of Jamaica Hope dairy cows is considered to be the best in Jamaica, and their herd management and animal feeding program is also highly regarded.

The Ministry of Agriculture

Major responsibility for agricultural research in Jamaica is vested in the Ministry of Agriculture. Given the fact that at the time of preparation of this study, a major reorganization of research and extension activities is in progress, two organization charts are included (Figures 4.2.1 and 4.2.2). Figure 4.2.1 represents in skeletal form the current administrative structure (July, 1978) and Figure 4.2.2 represents that proposed by the FAO/IDB Team as modified by the Ministry of Agriculture. It is expected that the finally agreed to structure (which must be approved by the Ministry of Public Service) will be changed very little from that shown in Figure 4.2.2. Personnel, budgetary data, and information on programs will, of necessity, refer to the existing organizational structure.

Departments currently conducting some research include the Crops and Soils Department, the Plant Protection Department, the Livestock

Figure 4.2.1. Present Organizational Structure of Research in the Ministry of Agriculture.

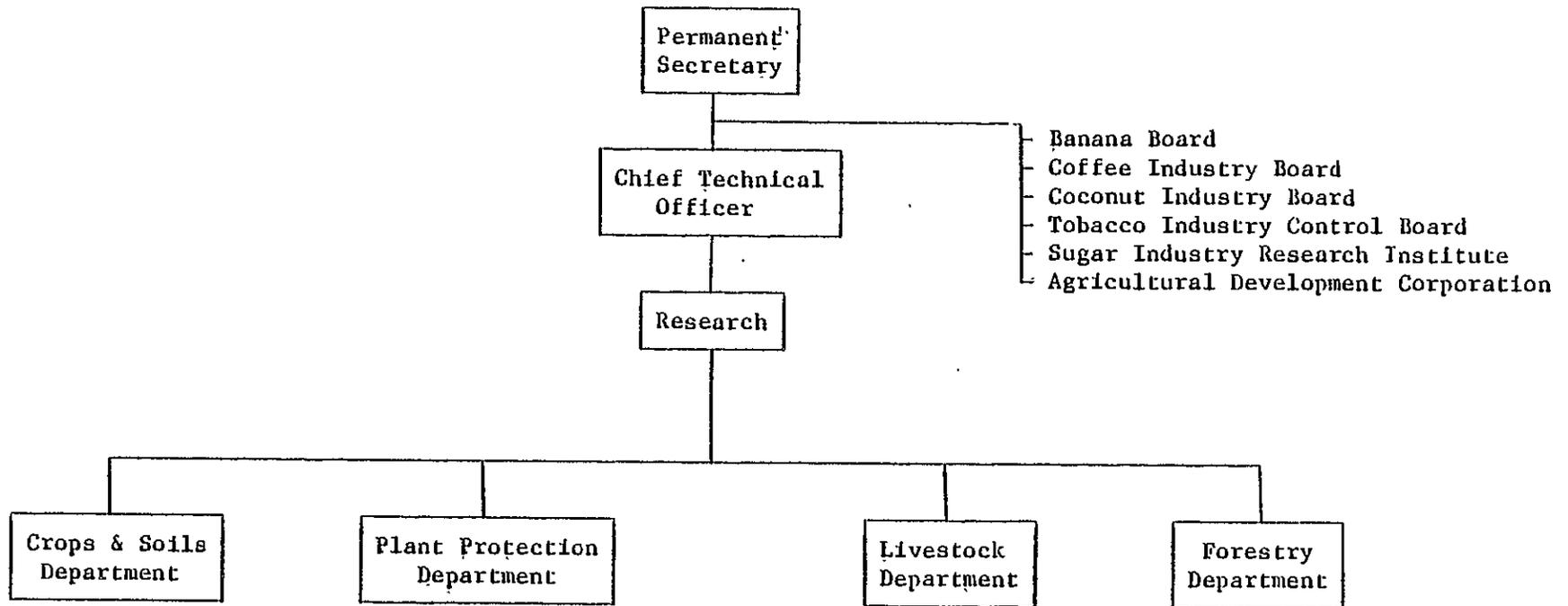
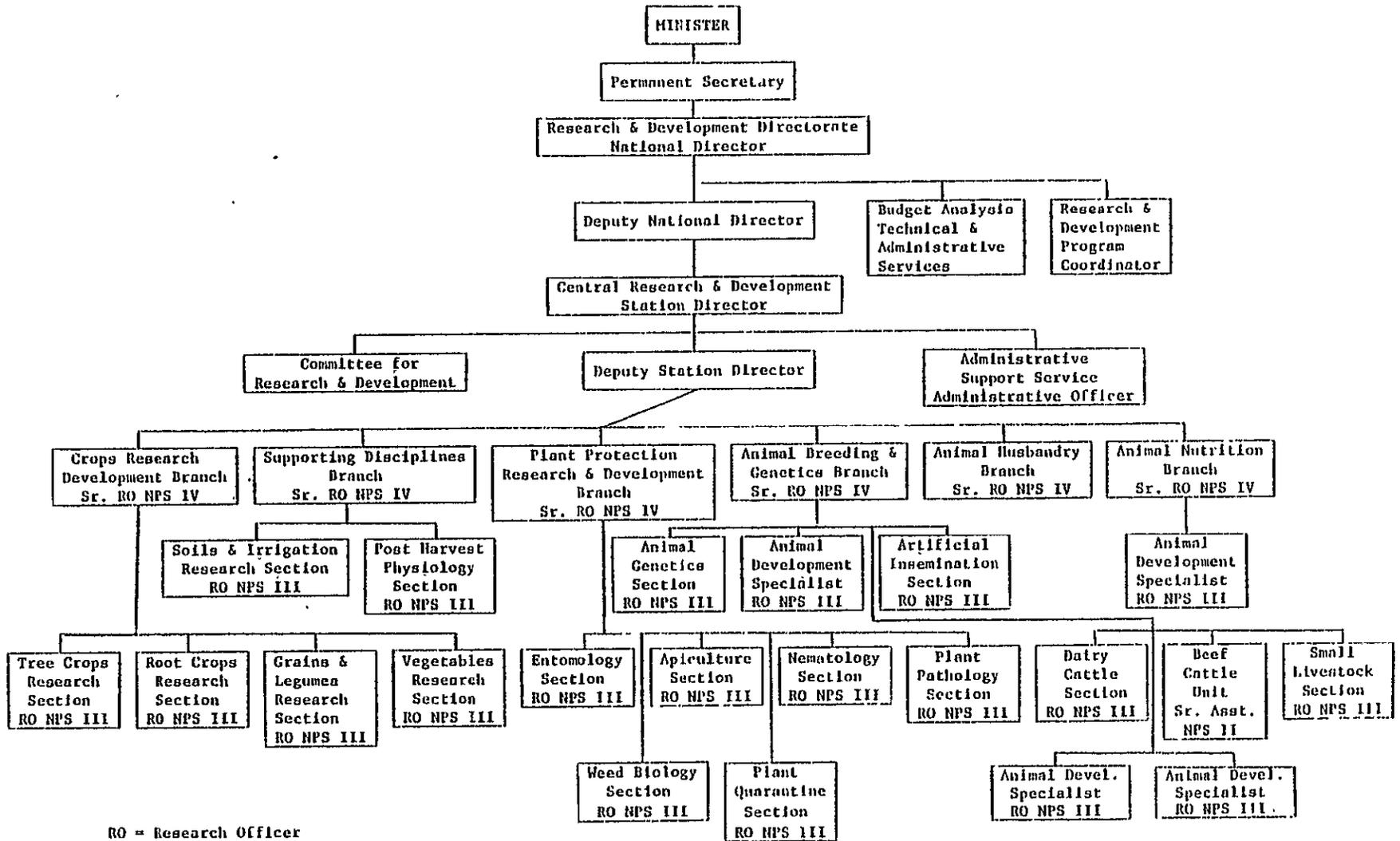


Figure 4.2.2. Ministry of Agriculture Research & Development, Proposed Reorganization as of July, 1979.



Department, the Forestry Department, and the Veterinary Department.

Personnel and activities of these departments are discussed below.

Crops and Soils Department. Although combined under one department head, the activities in crops and soils are sufficiently different to merit brief separate discussion.

Crops Research -- professional and technical research staff (in 1978) included one M.S., and nine B.S. level personnel. Approximately 80 percent of the research effort is directed towards varietal improvement and 20 percent towards improvement of cultural practices. No research is being carried out by this unit on cropping systems, irrigation and water management, or the economics of crop production.

An analysis of research projects carried out in 1976 shows work with field crops including cereal grains (maize, rice, wheat, and triticale); legumes (peanuts and winged beans); root crops (Irish potato, cassava, and sweet potato); castor beans; cotton; tobacco; and vegetable crops including: squash, cucumber, winged beans, lettuce, onion, peas, tomatoes, cho cho, pumpkin, cabbage, and a number of others; tree crops including pimento, cacao, ackee, avocado, guava, mango, and peach. In addition to research activities, there is also a significant allocation of resources to seed increase work on the experiment stations.

With some notable exceptions, the research program appears to be weighted towards observation trials, variety trials, and the establishment of plant museums, as opposed to projects directed to developing solutions to specific production problems of producers. Although it is recognized that plant introductions, variety trials, and observations form an integral part of any crop research program, a review of the 1976

research does not suggest a balanced research program. For example, of the 11 maize, rice, and wheat projects, four were variety trials, three were for seed increase, one was an extension demonstration, one was a herbicide trial, and one dealt directly with helping farmers to identify a rice variety that is acceptable to consumers. Of the four Irish potato trials, all were variety trials or observations. All of the vegetable work consisted of observation plantings. The work with pimento includes a significant amount of propagation (and production for sale) and observation. The cacao work appears to be more heavily weighted towards problem-solving research (black pod disease), intercropping systems, etc.

Soils Research -- The work of the soils research group is heavily oriented toward service activities rather than research and does not, in fact, even have a research budget. Its function is primarily that of an agricultural chemistry unit, analyzing soil, water, and plant material samples. This work is done both as a service to producers and in support of research work of various units of the Ministry of Agriculture, several statutory bodies, and other organizations. In addition, there are some actual research trials with fertilizers both in the field and in greenhouse experiments. Thus, it is difficult to assess exactly what percentage of personnel time and budget are allocated to functions of a research nature as compared to those of a purely routine service nature. Total staff (1978) included no Ph.D.s, three M.S., six B.S., and six secondary school graduates. In terms of research activities and those in support of research, a rough approximation would assign 1.5 man-year FTE and J\$53,570 expenditure to this area. A review of the 1976 Investigations shows field trials on N-P-K being conducted on the

Tulloch estate with kola plants during the period 1974-76, plus some field work at Allsides using the micro-plot technique in cooperation with IICA.

Plant Protection Department. Professional and technical researchers and support staff in 1978 included no Ph.D.s, 11 M.S., 5 B.S., 4 A.S., 4 diploma holders, and 5 secondary school graduates. This Department has responsibility not only for research and advisory work with plant pests (including weeds) and diseases, but is also responsible for plant inspection and quarantine regulatory work with pesticides, and other similar activities. The five major disciplinary areas of the Department include plant pathology, economic entomology, nematology, weed control, and apiculture.

A non-exhaustive sampling of research projects carried out in 1976 shows the following kinds of research.^{1/}

Plant pathology research activities:

1. plant virus disease survey of Jamaica (beans, canteloupe, cowpeas, cucumber, pepper, potato, pumpkin, tobacco, and tomato).
2. chemical control of floral shoot dieback on cashew.
3. disease control among vegetable crops.
4. disease resistance and tropical adaptability of various vegetable crops (cabbage, lettuce, pepper, squash).
5. control of black pod disease of cocoa.

^{1/} Data from Ministry of Agriculture, Investigations 1976, Bulletin No. 66, pp. 13-71. More current issues have not yet been published.

Nematology activities:

1. fertilizer response of pineapple on nematicide treated plots compared to untreated plots.
2. response of nematode-damaged pineapple plants to post-planting nematicide treatments.
3. comparison of effectiveness of alternative nematicides with pineapple.
4. nematode effect on tobacco yield.
5. nematode effect on plantain and testing of nematode on plantain.
6. cooperation with international project on root knot nematodes.
7. control of nematodes in yam planting material.

Economic entomology activities:

1. field test of chemicals to control the tomato fruit worm (which is also a pest of cotton and pigeon pea).
2. testing of alternative baits for control of cutworm caterpillars.
3. effect on cutworm population and reduction in potato damage from mounding potatoes at different levels of soil.
4. comparison of three insect sprays for cutworm caterpillar control.

Weed control activities:

1. use of non-specific herbicides to control weeds in rice paddy.
2. weed control in citrus nurseries.
3. weed control in sweet yams.
4. weed control in Irish potatoes and carrots.

An analysis carried out by the IDB of research trials conducted during the period 1971-76 inclusive shows the following:^{1/}

	Number of Trials					
	<u>1971</u>	<u>1972</u>	<u>1973</u>	<u>1974</u>	<u>1975</u>	<u>1976</u>
Plant Pathology	40	45	50	72	74	76
Economic Entomology	12	14	14	18	20	20
Nematology	14	15	17	22	24	25
Weed Control	10	12	12	14	15	18

The bulk of the research appears to be applied, problem-solving research carried out principally with crops grown and used for domestic consumption.

Livestock Department. Professional and technical research and support staff (1978) included two Ph.D.s, two M.S., five B.S., two A.S. (Associate Degree), and three diploma holders. Research activities are separated according to the following functions:

- 1) dairy cattle breeding and husbandry,
- 2) beef cattle breeding and husbandry,
- 3) pasture research,
- 4) animal nutrition.

As of 1978, in terms of research staff with B.S. level training or higher, two were working with beef cattle, three with dairy cattle, and four in the pasture research. A limited amount of nutrition and physiology research is being conducted with goats, sheep and rabbits, but responsibility for small livestock research has been transferred to the

^{1/} Annex 2 of "Agricultural Research Project," Inter-American Development Bank, April 10, 1979.

Agricultural Development Corporation (see discussion under statutory boards).

Beef cattle activities are carried out primarily at Grove Place research station which currently (1979) has eight breeding herds of Jamaica Red Poll, one herd of Jamaica Black, and one mixed herd. In total, there are 830 head of cattle on the station. In addition to research activities, the station provides bulls on loan to farmers, sells some heifers, and provides some artificial insemination service to farmers via local agents. Beef research focuses upon herd conception and growth rates, and a beef breeding program which includes: performance testing of bulls, cross-breeding for beef production, and cross-breeding for milk production. A limited number of feeding experiments with beef cattle are being conducted at the Bodles Research Station. Once completed, the station at Montpelier will be a site for both dairy and beef cattle research.

Dairy cattle activities are concentrated on the Bodles Research Station and include (1976 Investigations) maintenance and improvement of the Ministry of Agriculture Jamaica Hope herd, a national dairy expansion program, a dairy husbandry project, and a calf rearing trial. The total dairy herd numbers about 800 head including calves (1979). Dairy activities on the station appear to be a combination of production/development and research. One three-year project just completed focused on running dairy cattle on pasture alone, with no concentrates, and studies the impact on milk production. Given the fact that Jamaica must import almost all of its concentrates, and in view of the foreign exchange situation, this kind of applied research is needed. Another project compares Jamaica Hope and other dairy breeds.

Pasture research is conducted both at Bodles and at Grove Place. The program includes plant introduction and testing (grasses and legumes); grassland utilization (pangola, Bermuda, and the development of beef production systems with pastures); forage conservation; grass/legume compatibility trials; and sorghum trials. To date, not much success has been achieved in incorporating and maintaining legumes in pasture, and only limited research has been conducted in this area. Pasture researchers report that farmers historically have practiced low stocking rates on their pastures, have paid little attention to the economics of production, and have been accustomed to "opening a barrel of feed" rather than devoting the necessary time and resources to developing good pastures.

Forestry Department. Research conducted in past years in this department has been limited in scope, discontinuous in application, and results have been inadequately documented. Although numerous research projects have been planned, only a limited number were actually conducted, and a limited set of recommendations have evolved.^{1/} In 1973, the forestry research staff was composed of one B.S. level technician.

In 1978, efforts to establish a meaningful research program got underway with the appointment of an M.S. degree holding Forest Research Officer (who is currently serving as Acting Head of the Research Unit), and the development of a research plan. In addition to the Acting Head, the unit includes two B.S. graduates, one diploma holder, and five secondary school graduates. Research policy and programming is subject

^{1/} For a detailed account of the past research situation and future plans, see L. B. Graham, "Review of Forest Projects up to 1974" and "Forest Research," both undated, typescript documents.

to approval of the Forest Development Committee.

Primary emphasis (an estimated 90 percent of the research effort) will be devoted to pine, and is conducted primarily for the benefit of the Forest Industries Development Company (FIDCO). FIDCO and the Forestry Department own most of the pine plantings in Jamaica -- privately owned holdings are primarily hardwoods. FIDCO and the Forestry Department work closely together in the overall program. Total research budget in 1978 was only about J\$15,000, but the 1979 estimated budget is in the range of J\$128,000. This figure, however, substantially overstates the real research budget since a large portion of the funds are for a "Coffee Under Pines" project which is more developmental than research. Of this project, approximately J\$9,000 will be spent largely in research on six acres of project land. The Ministry of Agriculture is providing an additional J\$41,600 for research. The true 1979 research budget will be on the order of J\$50,000.

In order of priority, the planned research includes work with pines in the areas of: 1) seed production and tree improvement; establishment techniques; spacing and thinning; nursery research; 2) mensuration studies; 3) pest and disease protection; fire protection. Some research will also be conducted on mensuration, pest and fire protection, and establishment techniques with other forest species. The previously noted work with "Coffee Under Pine" will be continued. It is expected that one forestry specialist from Great Britain will be supplied in the near future to assist in developing and carrying out the research program.

The research and development work apparently is designed initially to benefit primarily FIDCO and the commercial plantings of the Forestry

Department, although eventually the research findings should be applicable to individuals and other enterprises interested in pine production.

Currently, the World Bank is considering a loan for a forestry project in Jamaica, primarily designed to finance expanded industrial plantations, sawmilling, and logging. However, the project contains provisions for a research/training program for both Forestry Department and FIDCO personnel. This component would include research on genetics, cultivation, and harvesting. It would also provide courses and on-the-job training in Jamaica to be conducted by international specialists, and financing for training in institutions located outside of Jamaica.

Veterinary Department. This department has no government mandate to conduct research, and probably less than five percent of the departmental budget and personnel effort are directed towards research activities. Given the assigned responsibility for disease prevention and control, import-export inspection, other regulatory services, and service to livestock farmers, there is virtually no time for research.

The research that has been conducted in recent years falls generally in the following areas:

1. research on the efficacy of commercial vaccine for prophylactic and therapeutic treatment to control vibriosis (disease causing infertility in cows). This work has been carried out under a joint Jamaica/CIDA Bovine Fertility Project. Reynolds Aluminum Company has cooperated in the research by providing cattle, pens, labor, and other support.

2. The CIDA project has also supplied one veterinarian and one graduate student from the University of Guelph to study the post-partum reproduction performance of Holstein and Jamaica Hope cattle under different nutrition regimes and Jamaican conditions.
3. Over the past ten years, Jamaica Red cattle have been studied, with an emphasis on breeding soundness evaluation and reasons for culling.

Specialists in the Department indicate the need for additional applied research on "Manchester wasting disease/Downer cow syndrome" -- thought to be a mineral deficiency, but still inadequately researched. Research is also needed on "shaker head syndrome" of goats -- thought to be a toxicology problem, but little work has been done on it to date.

A breakdown of activities of the Department indicates approximately 75 percent of personnel time and budget devoted to services of direct benefit to farmers (disease control, eradication, and clinical work with animals) 20 percent regulatory, and 5 percent or less devoted to research activities. Total staff includes 19 veterinary graduates and 42 animal health assistants who serve as veterinary paramedics.

Resources by Farm Size Groups

Introduction. This section reviews the manpower and financial investments made in agricultural research by subject matter areas, farm size categories, and function. Comparisons of expenditures for two time periods, 1973 and 1978, are made. In addition, an assessment of the adequacy of physical facilities and supporting infrastructure at existing research and production field stations is presented.

Table 4.2.3 presents a summary view of the personnel and budgetary situation and forms the basis for much of the discussion in this section. Table 4.2.4 further disaggregates these data by individual research organization. It must be emphasized that the allocations of personnel and budget among subject matter areas, and among the various sizes of farms, entails a somewhat arbitrary and less than fully satisfactory approach since no records are maintained on this basis. In order to acquaint the reader with the procedures followed, a brief section on methodology is presented.

Methodology for Allocating Expenditures and Personnel by Farm Size.

Research expenditures and personnel inputs for export crops were allocated on the basis of acreages planted to those crops in pure stand by various farm size groups (e.g., if the research budget for bananas for a particular research organization in a given year was J\$100,000 and 31 percent of the banana acreage in Jamaica was found on farms from one to five acres in size, then it was assumed that J\$31,000 of research expenditures were attributable to this farm size class). This assumption is defensible from the standpoint that the bulk of the technological recommendations derived from the research is neutral to scale (improved varieties, fertilizer recommendations, spray recommendations, plant population, cultural practices, etc.). However, in Jamaica the basic thrust of the research on most export crops is aimed at increasing the production on large farms and estates of commodities destined for export, and these production units are more apt to make use of the research recommendations. Thus, this limitation results in an overestimate of the allocation to the smaller farm sector. However, since it is small farmers who plant in mixed stand, their acreage is

significantly understated. The two biases work in opposite directions and tend to cancel each other. No better system of allocation is apparent since research organizations do not make personnel or expenditure estimates on the basis of farm size. It should also be noted that estimates of acreages in pure stands are from the 1968/69 census; the 1978/79 census data have been tabulated but not yet published, and were not made available at the time of this study. To the extent that the structure of agricultural production has altered since the last census, the coefficients used in this methodology will be inaccurate.

Research expenditures and personnel inputs for domestically consumed crops were allocated on the basis of a weighted average of acreages planted to yams, potatoes, and other crops (including vegetables, plantain, legumes, cereals, and other crops commonly consumed domestically) in 1968/69 by the various clientele groups. For example, if the research budget in a given year of an organization engaged in domestic crops research was J\$100,000 and 37 percent of the acreage of this "basket of domestic food crops" was planted on farms of one to five acres in size, then it was assumed that J\$37,000 of research expenditures were attributable to this clientele group. The other caveats previously noted in respect to export crop research expenditures also apply in this instance.

For those research organizations (such as the Crops and Soils Department of the Ministry of Agriculture) which conduct research on both export crops and domestically consumed crops, a weighted average was developed on the basis of percentage of budget devoted to each category. Using the "basket of domestic food crops" discussed above, and a "basket of export crops" developed from a weighted average of

sugar cane, bananas, coffee, cocoa, and coconuts, allocations were then made.

The allocation of livestock research expenditures and personnel among farm sizes is based upon the following procedure: 1) using 1968/69 census data, number of head of major livestock classes were calculated by size of holding; 2) all classes of livestock were converted to a standard animal unit in accordance with the weighting system in use in Jamaica (1 cow = 4 swine = 6 sheep = 8 goats = 300 poultry = 1 animal unit); 3) based upon an estimate of research personnel and research funds expended in the Ministry of Agriculture in research related to each class of livestock, and the numbers raised on each size of farm, estimates were derived.

This approach does not take into account any research that is being conducted by private enterprise (for example ALCAN with its Jamaica Hope dairy herd, or commercial broiler or swine producers), but in terms of real research, this expenditure appears to be limited in scope.

Professional and Technical Manpower. The first observation is that the number of scientific man-years engaged in agricultural research is small in terms of the requirements for a functional national research system. This suggests the necessity of focusing research in the short run at least, on those areas of research which:

- (1) are of high priority in terms of national agricultural development plans;
- (2) are currently lacking in appropriate research recommendations; and
- (3) require research in Jamaica as opposed to "imported" research findings.

Table 4.2.2.
 Conversion Coefficients Used in Allocation of Expenditures and
 Research Man-Years by Farm Size

Commodity	Percent Allocation by Farm Size in Acres				
	0 - .9	1. - 4.9	5 - 24.9	25 - 99.9	100 & Over
Export Crops:					
Sugar	0.3%	7.5%	12.6%	4.0%	75.6%
Bananas	3.0	31.0	34.0	8.0	24.0
Coffee	3.0	35.2	46.0	6.7	9.1
Coconut	0.6	6.4	19.3	11.2	62.5
"Weighted Basket"	0.9	12.8	19.1	5.8	61.4
Domestically Consumed Crops:					
"Weighted Basket"	5.2	37.4	33.3	5.7	18.4
Livestock:					
Cattle	3.1	11.6	17.3	6.4	61.5
Other--"Weighted Basket"	24.0	40.0	27.0	5.0	4.0

Table 4.2.4. Major Organizational Units Engaged in Agricultural Research Activities, Research Expenditure of Each, and Estimated Allocation of Expenditures by Farm Size. (Jamaican Dollars, 1978).

	Total Research Budget	FARM SIZE CATEGORIES IN AGRES									
		0-.9	%	1-4.9	%	5-24.9	%	25-99.9	%	100 & Larger	%
Banana Board	431,684	12,951	3.0	134,685	31.2	146,340	34.0	33,239	7.7	104,469	24.1
CARDI	120,000	6,240	5.2	44,880	37.4	39,960	33.3	6,840	5.7	22,080	18.4
Coconut Board	364,607	2,193	0.6	23,334	6.4	70,368	19.3	40,836	11.2	227,876	62.5
Scientific Research Council	219,109	11,394	5.2	81,947	37.4	72,963	33.3	12,489	5.7	40,316	18.4
Sugar Research Institute	810,000	2,430	0.3	60,750	7.5	102,060	12.6	32,400	4.0	612,360	75.6
Tobacco Industry Control Authority	19,000	--	--	11,400	60.0	7,600	40.0	--	--	--	--
Ministry of Agriculture:											
Crops	750,000	37,388	4.9	271,275	36.2	244,425	32.6	42,787	5.7	154,125	20.6
Soils	53,570	2,325	4.3	17,399	32.5	16,317	30.5	3,065	5.7	14,464	27.0
Forestry	15,000	--	--	--	--	--	--	--	--	15,000	100.0
Livestock	1,235,275	64,111	5.2	178,374	14.4	226,797	18.3	77,327	6.3	688,666	55.8
Plant Protection	321,052	11,173	3.5	88,483	27.6	88,674	27.6	18,428	5.7	114,294	35.6
Total	4,339,297	150,205		912,527		1,015,504		267,411		1,993,650	
Percentage of Total	100%	--	3.5	--	21.0	--	23.4	--	6.2	--	45.9

In the longer run, it may be possible through expanded training programs and grants (both domestic and foreign) to increase the overall numbers and training of research staff. Table 4.2.5 provides a breakdown of research personnel by level of training, and by employing institution. The skilled research manpower outside of the Ministry of Agriculture relative to those employed directly by the Ministry is striking.

It is also apparent that the allocation of professional and technical research manpower is biased in favor of the export crops as opposed to those crops produced primarily for domestic consumption. Table 4.2.6 shows that in 1978, 47.4 percent of the research manpower was working with export crops, compared to 39.1 percent with domestically consumed crops and 7.7 percent with livestock.

Table 4.2.6 also points up the lack of any research personnel working in the important areas of socio-economic research or public policy analysis. Although the planning unit of the Ministry of Agriculture has an economics staff, discussions with them suggest that they are not engaged in agricultural economic research, and only to a very limited extent in analytical activities. Similarly, although there is a substantial amount of activity in hillside terracing and erosion control, these are developmental action programs rather than research. There is essentially no scientific research manpower being devoted to real research in the resources category.

Viewing research personnel allocations from the perspective of clientele groups, based upon farm size, it is apparent that those producers in the 100 acre and larger category are the principal beneficiaries of agricultural research expenditures. Table 4.2.7 provides a breakdown of scientific manpower by farm size.

Table 4.2.5. Major Organization Units Engaged in Agricultural Research and Research Personnel by Level of Training, 1978.

Organization	Ph.D.	M.S.	B.S.	L.B.S.	Total
Banana Board	3	1	7	16	27
CARDI		2	5	7	14
Coconut Board		2	2	13	17
Sugar Research Institute	1	4	5	21	31
Scientific Research Council	2	6	7	12	27
Tobacco Industry Control Authority			1	1	2
Ministry of Agriculture:	(2)	(15.5)	(21.5)	(24.5)	(63.5)
Crops		1	9		10
Soils		0.5	0.5	0.5	1.5
Forestry		1	2	6	9
Livestock	2	2	5	5	14
Plant Protection		<u>11</u>	<u>5</u>	<u>13</u>	<u>29</u>
Total	8	30.5	48.5	94.5	181.5

Note: Information derived from personal interviews and written questionnaire. This table tends to overestimate personnel engaged in agricultural research to some degree (particularly in plant protection and livestock) because some of the activities carried out by the staff are largely service and developmental rather than truly research. There is an offsetting underestimation due to the fact that some agricultural research is conducted by the University of the West Indies (Mona), but information was not provided for inclusion. There is also some research activity carried out by private organizations such as ALCAN, Pioneer, etc., but their work is largely developmental, and comparable data were not obtained regarding their research activities.

Table 4.2.6. Man-Years and Educational Levels of Research Workers by Subject Matter, 1978.

Subject Matter Variables	Ph.D.	M.S.	B.S.	L.B.S.	Total	Percent
A. Resources	-	(.6)	(.3)	(.6)	(1.5)	(0.8)
1) Natural						
2) Technical	-	.6	.3	.6	1.5	0.8
B. Commodity	(8.0)	(29.9)	(48.2)	(93.9)	(180.0)	(99.2)
1) Export Crops	4.0	10.4	17.1	54.6	86.1	47.4
2) Domestic Crops	2.0	16.5	24.1	28.3	70.9	39.1
3) Livestock	2.0	2.0	5.0	5.0	14.0	7.7
4) Fisheries	-	-	-	-	-	-
5) Forestry	-	1.0	2.0	6.0	9.0	5.0
C. Socio-Economic						
1) Farm Management & Operation						
2) Marketing & Distribution						
3) Social & Cultural						
D. Public Policy	_____	_____	_____	_____	_____	_____
Total	8.0	30.5	48.5	94.5	181.5	100.0

Table 4.2.7. Man-Years and Educational Levels of Agricultural Research Allocated by Farm Size, 1978.

Client Groups	Ph.D.	M.S.	B.S.	L.B.S.	Total	Percent
1. Landless Farmers (1 acre or less)	.4	1.8	2.2	3.2	7.6	4.2
2. Small Farmers (1-4.99 acres)	2.1	7.4	12.9	19.0	41.4	22.8
3. Medium Farmers (5-24.9 acres)	2.1	8.4	13.3	22.4	46.2	25.5
4. Medium-Large Farmers (25-99.9 acres)	.4	2.5	3.2	6.5	12.6	6.9
5. Large Farmers (100 acres & over)	3.0	10.4	16.9	43.4	73.7	40.6
Total	8.0	30.5	48.5	94.5	181.5	100.0

Although farmers in the 0-5 acre size category represent approximately 78.5 percent of Jamaica's farm population, the scientific man-years allocated to the solution of their problems represent only 27 percent of the total.

Expenditures. Findings regarding the allocation of research expenditures closely parallel those concerning scientific manpower (refer to Table 4.2.3). Export crops in 1978 received an estimated 41.4 percent of national research expenditures, whereas the domestically consumed food crops received only 29.4 percent. Expenditures on livestock research were about the same as those devoted to domestically consumed crops (28.5 percent vs. 29.4 percent), but the bulk of these expenditures were devoted to cattle (over 90 percent) and very few research resources are currently being devoted to small stock.

It is also of some interest to note, in Table 4.2.3, that the percentage of the research expenditures allocated to export crops represented only 36.5 percent of the total in 1973 compared to 41.4 percent in 1978, and those allocated to domestically consumed crops have declined from 31.1 percent in 1973 to 29.4 percent in 1978. The percentage allocated to livestock research has also declined from 32.1 percent to 28.5 percent. The data also suggest some overall shift in expenditures in favor of larger farmers at the expense of the smaller farmers.

Comment. Whether the need for some realignment in allocation of resources is indicated by the findings presented above is, of course, a very complex issue. It is influenced not only by equity considerations, but also by the pressing need for foreign exchange earnings (hence export crops), by the limitations imposed by the natural resource base

(man/land ratios, soil quality, rainfall patterns, topography, etc.), and by the perceived potential for increasing national output among different commodity and clientele groups.

The findings do suggest, however, the importance of developing and following a reasoned plan for allocation of these scarce research resources among those areas which show the greatest potential for achieving the goals set forth for national agricultural development -- whatever they may be. There are not adequate resources to permit the luxury of engaging in research in a multitude of uncoordinated areas which are not of immediate high priority.

Physical and Human Resources at the Field Stations. In an effort to arrive at some judgment as to the adequacy of both physical facilities and human resources available to the various research stations and production/extension stations, two procedures were followed. In the first place, to the extent that time permitted, personal on-site visits were made to research stations (including Bodles, Top Mountain, Lawrencefield, Orange River, Grove Place, and Elim). Secondly, researchers and research administrators were asked to rate each of the stations in terms of adequacy of 18 variables on a one to five scale, with one being fully adequate and five being totally inadequate. These ratings, combined with personal evaluation where appropriate, resulted in a composite rating which is presented in Table 4.2.8. Three of the research facilities (Hounslow, Montpelier, and Smithfield) are only in the planning stages. No evaluations were obtained for three of the production/extension stations (not research facilities). A dash in a cell indicates that the variable is not applicable to that particular station. The Elim station is receiving some support from the Japanese government

Table 4.2.8. Assessment of Adequacy of Station Facilities.

Research Facility	Skilled Professionals	Support Staff	Field Labor	Vehicles	Farm Machinery	Farm Equipment	Expendable Supplies	Land	Fencing	Water (irrigation)	Water (domestic use)	Office Facilities	Laboratory Facilities	Storage Facilities	Equipment/Vehicle Maintenance	Security of Crops/Livestock	Access to Library Facilities	Access to Computer Facilities	
1. Bodles	3	5	2	5	3	4	4	1	4	2	2	4	3	3	4	5	4	5	
2. Top Mountain	2	4	1	1	3	3	4	3	5	3	2	3	2	3	5	5	3	5	
3. Lawrencefield	2	2	1	2	4	4	3	2	5	4	3	2	3	3	5	5	3	5	
4. Hope																			
5. Orange River	2	4	1	1	4	4	4	3	5	5	2	3	4	5	3	5	3	5	
6. Beverly	1	1	1	-	5	1	1	3	1	1	1	1	-	1	5	2	-	-	
7. Grove Place	3	4	2	3	3	4	4	1	3	-	4	3	5	3	3	3	4	5	
8. Elim	3	1	1	1	1	1	1	1	3	1	1	2	5	5	2	2	-	-	
9. Hounslow (proposed)																			
10. Montpelier (proposed)																			
11. Smithfield (proposed)																			
Production/Extension:																			
1. Hope	2	2	1	2	-	-	-	-	2	5	1	2	-	3	5	2	1	-	
2. Charlton	5	3	1	3	3	3	1	1	3	4	1	1	-	2	5	2	1	-	
3. Sunning Hill																			
4. Hartease																			
5. Lyssons																			
6. Irvin	5	2	1	2	-	-	1	1	-	-	1	1	-	1	5	2	1	-	
Kingston Central Office	3	3	-	5	-	-	2	-	-	-	-	4	-	-	-	-	3	5	

at the present time.

A review of Table 4.2.8 points out serious deficiencies in fencing and security for growing crops and livestock. Theft of produce (praedial larceny) in some areas renders meaningful field research virtually impossible. It is also apparent that farm machinery and equipment are inadequate, maintenance very weak, and laboratory facilities generally inadequate. The availability of expendable supplies in support of the research activities is also unreliable and is considered to be inadequate at most of the stations. Access to computer facilities is rated as totally inadequate, but it should be noted that there do exist commercial computer facilities in Kingston which could be utilized when and if the research program requires it.

Institutional Linkages

Among Domestic Research Institutions. The linkages among domestic research organizations include both formal and informal arrangements and cover a wide range of intensity of contact. Table 4.2.9 provides an illustration of inter-acting organizations. Various research units of the Ministry of Agriculture carry out trials jointly with other organizations (for example, the Crops and Soils Department supplies materials and conducts trials jointly with the Scientific Research Council, the Storage and Infestation Division of the Ministry of Commerce and Industry, and the Jamaica Industrial Development Corporation, and provides land and other facilities for various of the statutory boards to conduct research trials and to propagate plant materials; it supplies seed materials to the Sugar Research Institute for research on crop diversification on sugar estates; it provides soil and tissue analysis services

Table 4.2.9.

RESEARCH INSTITUTIONAL LINKAGES

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	Banana Board	CARDI	Cococut Board	Coffee Board	Scientific Research Council	Sugar Research Institute	Tobacco Industry Authority	UWI (Mona)	Crops & Soils	Forestry	Livestock	Plant Protection
Banana Board		x	x		x			x	x			x
CARDI	x				x	x			x		x	x
Cocoa Board			x					x				x
Coconut Board	x			x				x	x			x
Coffee Board			x						x			x
Scientific Research Council	x	x							x	x	x	
Sugar Research Institute		x						x	x			x
Tobacco Ind. Control Auth.									x			x
UWI (Mona)	x		x						x		x	
Crops & Soils Dept. (MOA)	x	x	x	x	x	x		x				
Forestry Dept. (MOA)					x							
Livestock Dept. (MOA)		x										
Planning & Data Processing (MOA)					x							
Plant Protection Dept. (MOA)	x	x	x	x		x						
Production Unit (MOA)					x							
ACORBAT												
Agri. Devel. Corp.												x
Agri. Extension	x	x	x	x		x		x	x	x	x	
Agro-Industry groups										x		
Agri. Marketing Corp.									x			
Agri. Research Council (UK)								x				
Agri. Research Institute (Germany)								x				
Bauxite companies (various)										x		
Bureau of Standards					x							
CARDI												
Caribbean Development Bank		x										
CATIE		x										
CIAT									x			
CIDA (Canada)		x										
CIMMYT									x			
CIP									x			
CTBC									x			

Cont'd.../Citrus Growers'

	Banana Board	CARDI	Coconut Board	Coffee Board	Scientific Research Council	Sugar Research Institute	Tobacco Industry Authority	UWI (Mona)	Crops & Soils	Forestry	Live-stock	Plant Protection
Citrus Growers' Assn.									X			
Commonwealth Mycological Association												X
Cuban Ministry of Agri.						X						
European Devel. Fund (EEC)		X										
FAO			X									
FIDCO										X		
IICA	X	X		X					X			X
IITA		X										
IRDC		X										
Int'l. Meloidogyne Project												X
Jamaica School of Agri.									X		X	X
JIDC	X	X			X				X			
Lethal Yellowing Research Council (Univ. of Florida)			X									
Ministry of Mining (Natural Resources Conserv. Div.)										X		
Ministry of Commerce & Industry (Storage & Infestation Division)		X		X					X			
Nat'l. Water Authority & Water Commission						X						
No. Carolina State Univ. (US)							X					
Regional Food Plan		X										
Sugar Research Institutes (various)						X						
ICRISAT									X			
IRRI									X			

Cont'd..../U.K. East Malling

Research Institutional Linkages (Cont'd.)

	Banana Board	CARDI	Coconut Board	Coffee Board	Scientific Research Council	Sugar Research Institute	Tobacco Industry Authority	UWI (Mona)	Crops & Soils	Fores-try	Live-stock	Plant Pro-tection
U.K. East Malling Research Station			x									
U.K. Ministry of Overseas Development			x									
U.K. Rothamstead Research Station			x									
U.K. University of Oxford										x		
U.K. Wye College			x									
University of Hanover (Germany)								x				
U.S.A.I.D.		x	x									
U.S.D.A						x						
University of the West Indies (Trinidad)						x			x			x

Note: Information derived from personal interviews and a written questionnaire completed by the various Jamaican institutions engaged in agricultural research. This matrix is considered to be illustrative but not exhaustive.

to researchers in the Coconut Board, the Tobacco Industry Control Authority, and on occasion to the Banana Board and the Sugar Research Institute; it provides analytical service to the Citrus Growers' Association, the Coffee Board, and to Agricultural Extension). Similar linkages in varying intensity exist among other units.

From discussions, however, it is clear that often one research institution is not well informed regarding the on-going research activities of others which are carrying out research which would be of mutual benefit. There is currently no formalized functional system to bring together research administrators of the various organizations on a regular basis to discuss research programs, problems, and progress, and to communicate this information back to the individual scientists in the respective organizations. Thus, there is an undue amount of duplication, and some misallocation of scarce research resources. In summary, the current system of linkages, although quite good among some individuals and some organizations, is not judged to be adequate in the aggregate. Jamaican researchers, generally, are quite aware of the weaknesses in the system and are interested in devising ways and means to improve it.

With International Organizations. The linkages established between domestic research organizations and research institutions abroad are quite strong in some instances, and rather weak in others. Table 4.2.9 indicates some of the linkages which were identified during this study, and they cover the range of increasing intensity from exchange of printed materials and germ plasm, to the provision of visiting research personnel, to the conduct of joint trials in Jamaica.

Some examples of close cooperation include the following: the Tobacco Industry Control Authority (TICA) has an operating agreement with North Carolina State University whereby specialists from the University visit the Cigarette Company of Jamaica annually, and TICA staff have visited North Carolina State; the Inter-American Institute of Agricultural Sciences (IICA) has an office in Jamaica which includes four Ph.D.s working with Jamaican counterparts on agricultural research and development projects; the IICA office in Costa Rica supplies plant materials, printed matter, and training programs in support of a number of Jamaican research activities; most of the Jamaican research institutions have established linkages with the Caribbean Agricultural Research and Development Institute (CARDI), particularly since the establishment of the Jamaican office in 1974; the Coconut Industry Board participates in activities of the Lethal Yellowing Research Council which is based at the University of Florida, and cooperates with a number of research organizations in the United Kingdom (the U.K. Ministry of Overseas Development has provided technical specialists in pathology, the use of electron microscopes, and entomology); in recent years, USAID has provided technical, research, and development specialists in the areas of marketing, fisheries, and other areas; the Agricultural Development Corporation has an arrangement with a wool specialist in Virginia who has made regular trips to Jamaica to assist in the development of the industry; the Sugar Research Institute maintains linkages and receives plant materials from a number of foreign institutions including the U.S. Department of Agriculture, the Cuban Ministry of Agriculture, and the Sugar Cane Research Program in Barbados.

Generally, the intensity of international cooperation is a function of the research activity of individual scientists who establish and maintain scientific contacts through presenting papers at international meetings, publishing in scientific journals and exchanging publications and correspondence on on-going research and problems encountered, and participation in conferences and seminars. Some Jamaican research organizations have been more effective in providing financial support for their scientists to participate in this essential interchange than have others -- and the opportunities in this area have declined as the balance of payments problems have worsened.

With Educational Institutions. Since the research function and the educational function are administratively separated in Jamaica, the extent of linkage is significantly less than one would expect to find (for example) in one of the state systems in the United States.

Cooperation with the University of the West Indies (Mona Campus) is informal and on a very modest scale -- particularly so since this campus does not include an agricultural faculty, and there is, in fact, no college of agriculture in Jamaica. There are, however, numerous examples of cooperative activity on an individual basis. On occasion, Ministry of Agriculture research specialists serve on thesis committees of graduate students in the Faculty of Natural Sciences at the University. Some research activities have been conducted jointly between the University and the Ministry of Agriculture, the University and the Banana Board, and the University and the Coconut Board. Some research specialists of the Ministry of Agriculture serve as part-time lecturers in their fields of specialty at the Jamaica School of Agriculture.

The net conclusion, however, is that functional linkages between the research and the educational systems are only weakly established at the present time, and it is not apparent that any particular plans are being made to strengthen these ties.

With the Extension System. Research and extension workers of the Ministry of Agriculture cooperate in field days, provision of supplies and materials, the development of technical recommendations, etc. However, discussions with both research workers and extension workers indicate that the linkages are currently inadequate. This inadequacy is recognized by Jamaican administrators, and there are plans for strengthening these linkages.

There does not appear to be available to extension workers any significant packages of research recommendations which have been thoroughly field tested and found to be economically feasible under prevailing conditions. This is particularly true of those crops which are produced primarily for domestic consumption (e.g., yams, plantain, fruits, vegetables, and cereal grains produced on the smaller farms).

The Livestock Department, historically, has achieved a better integration of research and extension activities through its livestock development specialists, who function essentially as extension specialists, but who are closely linked to the livestock researchers. In the current reorganization of the Ministry of Agriculture, it is planned to implement this livestock model among the other agricultural disciplines.

Better integration of research and extension has also been achieved in past years for individual export commodities through the various commodity boards which historically have carried out both research and extension activities in support of their respective clientele. This

has, of course, also led to some duplication of effort throughout the research and extension system -- which the proposed reorganization hopes to correct.

Commodity groups (particularly sugar cane and coconut growers) appear likely to oppose any efforts to bring these activities under the Ministry of Agriculture, since they perceive this as a diminution in both the quality and quantity of services which are currently provided directly to them.

Incentives

Salaries. With the deteriorating economic situation and high inflation rate, salaries of agricultural research personnel have shown a steady decline in real terms. The situation is particularly acute among Ministry of Agriculture personnel. Table 4.2.10 shows the salary scales for major categories of professional employment at the time of preparation of this study. At the prevailing exchange rate of approximately J\$1.77 = US\$1, these data indicate that the top salary for a research scientist was (NPS Grade IV) US\$7,683. There are, however, few Grade IV positions in the Ministry of Agriculture; most researchers hold Grade I or II positions, where the top annual salary is US\$5,378 and US\$6,294, respectively.

While these salaries may appear relatively attractive in comparison to salaries in many developing countries, it must be recognized that Jamaica has in the recent past enjoyed a substantially higher standard of living than is now possible, and Jamaicans have adjusted expectations to that level. Thus, the current situation is one in which both quasi-governmental institutions and private organizations have been able to bid

Table 4.2.10. Salary Schedule for Ministry of Agriculture:
 Selected Major Categories, 1979
 (Jamaican Dollars)

Executive Management Group: (Permanent Secretary)

<u>Grade</u>	<u>Entering Salary (Annual)</u>	<u>Annual Increment</u>	<u>Maximum</u>
EMG II	\$15,500	\$500	\$19,500
EMG I	14,040	480	18,360

Applied Sciences Group: (Engineers)^{1/}

<u>Grade</u>	<u>Entering Salary (Annual)</u>	<u>Annual Increment</u>	<u>Maximum</u>
ASG IV	\$12,520	\$480	\$13,960
ASG III	11,140	420	12,400
ASG II	9,700	360	11,140
ASG I	7,120	300	9,520

Natural, Physical, & Social Sciences Group: (Agricultural Officers)^{2/}

<u>Grade</u>	<u>Entering Salary (Annual)</u>	<u>Annual Increment</u>	<u>Maximum</u>
NPS IV	\$12,160	\$480	\$13,600
NPS III	10,780	420	12,400
NPS II	9,700	360	11,140
NPS I	7,120	300	9,520

Cont'd...../

Table 4.2.10. (Cont'd.)

3/

General Sub-Group: (Extension Officers & Farm Managers)

<u>Grade</u>	<u>Entering Salary (Annual)</u>	<u>Annual Increment</u>	<u>Maximum</u>
PST/GN IV	\$ 8,080	\$420	\$ 9,340
PST/GN III	7,000	360	8,080
PST/GN II	5,800	300	6,700
PST/GN I.	3,880	240	5,800

General Sub-Group: (Field Assistants & Headmen)

<u>Grade</u>	<u>Entering Salary (Annual)</u>	<u>Annual Increment</u>	<u>Maximum</u>
TSS/GT VII(A)	\$ 9,160	\$480	\$10,600
TSS/GT VII(B)	10,080	480	11,040
TSS/GT VI	7,900	420	9,160
TSS/GT V	6,760	360	7,840
TSS/GT IV	5,360	300	7,060
TSS/GT III	4,840	240	5,800
TSS/GT II	3,700	180	4,600
TSS/GT I	2,980	120	3,580

Cont'd...../

Table 4.2.10. (Cont'd.)

Labour and Mechanical Operations Group:

<u>Grade</u>	<u>Entering Salary</u>	<u>Annual Increment</u>	<u>Maximum</u>
LMO V	\$ 4,348 per annum	\$240	\$ 5,068
LMO IV	\$ 68.65 per week	\$3.45	\$ 79.00 per week
LMO III	58.30 " "	3.45	68.65 " "
LMO II	51.40 " "	2.30	58.30 " "
LMO I	40.50 " "	1.70	47.30 " "

1/ All of the personnel occupying these positions have degrees.

2/ Most of the personnel occupying these positions have degrees.

3/ Most of the personnel occupying these positions do not have degrees.

effectively for the services of Ministry of Agriculture research personnel. Several of these organizations are not bound by the same set of salary schedules as is the Ministry of Agriculture. It should also be noted that in instances where external funding has been available under a joint project arrangement, it has been common practice to supplement the salaries of personnel assigned to these projects by as much as 25 percent. Organizations may also provide varying fringe benefits such as allowances for housing, automobiles, vacations, etc. For the above reasons, recruitment and retention of qualified research personnel has become increasingly difficult in recent years.

Although it has not been possible to quantify in any statistically meaningful way, the general impression is that the gap between Ministry of Agriculture salaries and those of other Jamaican institutions employing researchers of similar training and skill levels (e.g., the University of the West Indies, CARDI, the Jamaica Bauxite Institute, the Jamaica Development Bank, and some of the statutory boards) ranges between 10 and 100 percent. There has been some discussion of attempting to raise the Ministry of Agriculture salaries and some of the statutory boards to levels comparable with the University of the West Indies. By 1981, UWI salaries are scheduled to be approximately J\$28,284 for a Professor, J\$22,848 for a Senior Lecturer, J\$20,049 for a Lecturer, and J\$14,589 for an Assistant Lecturer. As shown in Table 4.2.10, these salaries are well above 1979 Ministry of Agriculture salaries. Private industries in Jamaica offer salaries significantly higher even than these, and there is of course some movement of researchers to higher paying positions in other countries or with multilateral research organizations (FAO, IICA, Caribbean Development Bank).

Program Support. Capital investment in agricultural research in terms of scientific equipment, farm machinery, and vehicles has been insignificant in recent years, largely as a result of a highly unfavorable balance of payments and the necessity for the government to curtail imports of all commodities. This situation has also had a substantial impact on the availability of imported expendable supplies including feeds, seeds, fertilizers, pesticides, and the myriad of other items essential to a smoothly functioning agricultural research program. Almost none of these items is locally manufactured. To a greater or lesser degree, all institutions conducting agricultural research in Jamaica have been adversely affected.

Promotion. The Ministry of Agriculture has a standardized personnel evaluation form, and the heads of departments are instructed to complete an annual performance rating of each employee. Discussions with a number of agricultural researchers in different departments suggest, however, that there is little confidence in the existence of a strong correlation between research performance, rating assigned, and ultimate reward (or punishment) received. There is also a strong sentiment expressed by a number of individuals that good research work, by itself, is not adequate for movement up the professional grades -- that greater weight is assigned to administrative duties, and in order to aspire to the higher ranks it is necessary to take on these duties. It also appears that the present allocation of the higher position grades among departments rests largely on an historical base rather than on any recent attempt to carry out a reasoned position classification based upon research priority needs. This results in individuals moving from department to department (even outside of their technical fields)

as higher grade positions become vacant, rather than the up-grading of research areas that may need it. Finally, although the system presumably is based upon performance rather than seniority or other considerations, it is not apparent that researchers generally feel that this principle is universally practiced.

Professional Improvement. Few researchers or research administrators feel that adequate provision is made for research personnel to improve themselves professionally through government-financed participation in seminars, conferences, sabbatical leaves, and similar activities. Such activities have been severely curtailed as a result of the current economic crisis, but it does not appear that a strong professional improvement program was institutionalized into the system of the Ministry of Agriculture even in prior years. Although there was previously much greater opportunity to attend international conferences, there has apparently never existed a system for paid sabbatical leaves. It should be noted that the Ministry has provided a number of opportunities for researchers to receive government-supported advanced academic training, and to some extent this continues even during today's economic situation.

Some departments (notably Forestry) which have external funding support appear to provide much greater opportunity for professional improvement. Some of the statutory boards and the University of the West Indies are also better endowed in this respect.

The system provides little incentive for researchers to publish their findings in international scientific and professional journals, and no such national journals exist. Thus, although some individuals successfully make the effort to publish in such outlets, they

represent the exception rather than the rule. This, in turn, tends to reduce opportunities for establishing a continuing dialogue with research workers in other countries.

Public Service Philosophy

The agricultural research being conducted in Jamaica is very applied and appears to be directed towards addressing the needs, as researchers perceive them, of the clientele groups. This is particularly evident among the commodity boards, and only slightly less so within the Ministry of Agriculture. Thus, it appears that there is strong evidence of a public service orientation as opposed to a major loyalty to an organization or a discipline. This orientation appears to be accepted at all levels of the research organization, from top administration through individual researchers.

A review of the materials presented in Table 4.2.3 suggests a bias towards the larger holdings in terms of allocation of both personnel and budget. It also suggests that the research in both the natural science and the socio-economic areas has been neglected. A further observation is that emphasis has been directed more towards the export crop sector than towards the sector which produces primarily for domestic consumption. If the personnel and expenditures of CARDI (which is a quasi-Jamaican institution) and the Scientific Research Council were removed from the tabulation in Table 4.2.3, this export orientation would be much greater. Within the Crops and Soils Department of the Ministry of Agriculture, which would be expected to have major responsibility for research activities concerned with domestically produced and consumed crops, personnel actively engaged in research include only 1.5 full time

equivalent (FTE) M.S. degree and 9.5 FTE B.S. degree holders. Within the livestock sector, it is apparent that the bulk of the research budget (90 percent or more) is devoted to cattle (both dairy and beef) and that very little research attention is being given to goats, swine, or poultry. These latter classes of livestock are produced to a greater extent by smaller operators, whereas cattle production is, of necessity, carried out on larger holdings. Research and development activities concerned with small livestock have been recently assigned to the Agricultural Development Corporation, but no provision for research personnel or budgetary support has been made. Thus, there appears to exist some imbalance in the overall research system.

In terms of utilization of the output of the research system by the various clientele groups, some non-quantifiable observations can be made on the basis of discussions with a non-random sample of researchers, extension workers, administrators, and farmers. The impression is that the larger single commodity estates and farms (sugar, coconut, banana) and some of the smaller single commodity producers (coffee, cocoa) are fairly quick to adopt new varieties and recommended practices, particularly where close contact is maintained with commodity board quasi-extension personnel. Smaller farmers producing largely for home consumption and local sale and farming hillside areas appear to have been little affected by the REE system to date.

Knowledge Generation and Dissemination

Gathering Information. As implied in the discussion of international linkages, Jamaican researchers are reasonably well tied into the international knowledge network. Linkages are perhaps better

established by scientists working in the commodity boards, because they have been better funded and have received more attention and support from foreign research centers and other organizations. Relative to other developing countries, Jamaica's overall system of interchange with foreign institutions is good, and Jamaica relies to a fairly high degree on "imported research" which may then be subjected to adaptation within the Jamaican environment. This system tends to break down, however, in terms of the development of economically feasible packages of technology which are appropriate to the large numbers of small hill farmers who produce the bulk of Jamaica's food supply.

Storage and Retrieval. Some of the commodity boards maintain their own scientific libraries, complete with journal subscriptions. The Sugar Research Institute at Mandeville is perhaps the best equipped in this respect. Access to library facilities on the Mona campus of the University of the West Indies is provided for Ministry of Agriculture researchers and others.

Although commercial computer facilities are available in Jamaica, the only organization (other than the University) which currently appears to be using these in an active research program is the Sugar Research Institute.

The Ministry of Agriculture publishes an annual report of research activities entitled Investigations. This is a very useful publication and appears to be well used in Jamaica and distributed abroad, but there is significant lag time between completion of research and appearance in the publication -- the 1976 edition is the most recent one to be published, although the 1977 edition is nearing publication.

Human Resources. The human resources devoted to agricultural research in Jamaica, particularly in the Ministry of Agriculture, are rather limited relative to those found in a number of developing countries at similar levels of development. The number of research staff who have received graduate level training in their disciplines is inadequate, and the overall research program suffers from a lack of focus. This is well recognized by Jamaican administrators, and means for improving the system are being actively sought.

One obvious weakness in the system is the lack of attention currently devoted to testing and economic analysis at the farm level of recommended crop production practices. Until extension workers can feel confident that the recommendations which they make to farmers have a very high probability of significantly increasing net returns to those who opt to follow these recommendations -- and farmers become convinced that these recommendations have in fact been proven -- adoption rates are likely to remain low.

There also appears to be a need for expanded research (as opposed to developmental activities) aimed at soil conservation, terracing, and cropping systems for small hill farmers. Significant amounts of developmental program funds are being expended in these areas on the basis of very little research analysis, either of a technical or a socio-economic nature.

Critical Mass of Scientific Personnel

Jamaica is relatively small, and most trained research personnel presently live in or near the capital city (Kingston). Thus, the potential for intellectual interchange among professionals exists, and

there is a fairly active professional organization of scientific agricultural personnel which provides a forum. Nevertheless, the number of research personnel with post-graduate training is small, and scientific fields are not uniformly represented. In the entire research system (excluding the Faculty of Natural Sciences of the University of the West Indies, whose function is largely teaching) there are only eight Ph.D.s and 30.5 FTE M.S. degree holders whose assignments are primarily in the area of research (see Table 4.2.5). Among these, there appears to be a very heavy weighting towards plant protection (71 percent of the M.S. degree holders engaged in research in the Ministry of Agriculture and 36 percent of those represented in the entire system). Although the soils component of the Crops and Soils Department employs three M.S. and seven B.S. graduates, only 1.5 FTE is engaged in research. Only one M.S. (FTE) is engaged in crops research in the Ministry of Agriculture. These numbers illustrate the point that a critical research mass does not presently exist in the Ministry of Agriculture. Some of the boards are in significantly better position in this respect, and probably do not require major increases, particularly in view of the plan for eventual amalgamation of research activities under the Ministry of Agriculture umbrella.

The needs for additional research personnel, as viewed by administrators and specialists in the responding departments and organizations, are presented in Table 4.2.11.

Table 4.2.11. Indicated Additional Personnel Needs, by Institution and Level of Training.

Organization	Ph.D.	M.S.	B.S.	L.B.S.	Total
Banana Board		3	1		4
CARDI					0
Coconut Board			1		1
Sugar Research Institute	1	5			6
Tobacco Industry Control Authority			1	1	2
Scientific Research Council		1	1	2	4
Ministry of Agriculture:					
Crops		4			4
Soils		2		1	3
Forestry			1	2	3
Fisheries					0
Livestock		4		1	5
Plant Protection		9	5		14
TOTAL	1	28	10	7	46

A comparison of Tables 4.2.11 and 4.2.12 suggests that those departments and organizations which already have a significant on-going research program (e.g., the Sugar Research Institute and the Plant Protection Department) are quite interested in expanding their research staff. It should be noted that CARDI staffing is limited by agreement to the current professional staff, and thus CARDI did not indicate additional personnel needs. The Fisheries Department does not have a

research program and does not feel the need for one, indicating that research findings can be successfully borrowed from abroad and put into practice in Jamaica with only minor modification.

The current plans of the administration of the Ministry of Agriculture for additional research staff positions are shown in Table 4.2.12.

Table 4.2.12. Current Ministry of Agriculture Plans for Additional Research Positions.

Area of Specialization	Level of Training	Number
Animal Nutrition	M.S.	1
Animal Husbandry (small stock)	M.S.	2
Animal Physiology	M.S.	1
Pastures	M.S.	1
Agronomy	M.S.	4
Entomology	M.S.	1
Research Assistants	L.B.S.	20
TOTAL		30

These new positions are to be established in conjunction with the reorganization of research in the Ministry of Agriculture and with the support of the IDB Loan Agreement which was recently signed. Of the ten planned new M.S. level positions, five are in the livestock area. It should be noted that two of these are to specialize in small stock, an area of research and development which is currently seriously

under-represented. However, the new staffing does not provide scientific manpower in the areas of socio-economic analysis, resource management and conservation research or soils research.

EXTENSION

Extension History^{1/}

Agricultural extension activities in Jamaica began with the founding in 1895 of the Jamaica Agricultural Society (JAS) which was charged with collecting and disseminating useful agricultural information among farmers, encouraging improved crop production and livestock feeding practices, and generally representing the needs of the agricultural sector. Initially, it was primarily the large farmers who were producing bananas, sugar, coffee, coconuts, and cattle who participated in these efforts. The stature of the JAS was enhanced by the fact that the Governor of Jamaica served as its president for many years, and other officers were selected from among the upper strata of society.

As the JAS began to establish its role, it became apparent that a staff of trained and experienced agriculturalists should be employed and assigned the task of carrying out extension functions. The first "agricultural instructor" was hired in 1897, two years after the society was founded. As the JAS matured and grew in influence, additional staff members were hired and were assigned the task of organizing farmer groups at parish and area levels. Farm and home visits were initiated, demonstrations of improved practices organized, and commodity and

^{1/} The primary source of the material in this section is Henry, D. D. and I. E. Johnson, Agricultural Extension Service in Jamaica, IICA, Kingston, March, 1979.

cooperative groups established. Services and contacts were expanded to include medium and smaller farmers in the extension programs.

In the 1940's, the JAS was instrumental in the creation of such organizations as the Citrus Growers' Association, the All-Island Banana Growers Association, the Coconut Association, the Coffee Association, and the Cocoa Growers Association. As each commodity group pressed for increased assistance with its specific crop, the short-staffed JAS was no longer able to supply adequate services. Thus, each of the commodity groups began to employ specialized staff to serve its particular clientele group. This practice resulted in some duplication of effort and confusion among farmers.

As a result of farmer complaints, an assessment of the system was undertaken in 1950-51 by the Department of Agriculture, and it was determined that there was need for coordination of extension activities. It was recommended that:

1. An appropriate policy for agriculture and rural development be defined.
2. The areas of responsibility of the various organizations be delineated.
3. Consolidated programs relative to these responsibilities be developed.
4. Continuing evaluation of all levels of the extension programs be carried out by the government with the objective of ensuring coordination.

This constituted the first attempt at integration of Jamaica's agricultural extension programs, and implementation of these proposals required increased funding. The Extension Service was transferred from the JAS

to the Department of Agriculture (which became the Ministry of Agriculture and Lands shortly thereafter) and funds were provided through a grant from Colonial Development for the general improvement of agriculture.

In the newly integrated system, the participating agencies, with extension type activities included the Extension Service of the Ministry of Agriculture and Lands, the Jamaica Agricultural Society, the Jamaica Social Welfare Commission, the Cooperative Department, the Primary Producers' Associations, and the Land Authorities. The major thrust of the extension program became one of developing farm plans for individual farmers, but assistance was limited to a relatively small number of participants. This resulted in discontent and criticism on the part of those farmers outside of the system.

During the period 1951-1955, although considerable success was achieved in integrating the various extension services, each agency continued to struggle to maintain its individual identity. The need for further coordination was recognized, and in 1955 a Standing Committee on Coordination of the Extension Services was established. This committee included the director of extension of the Ministry of Agriculture and Lands (Chairman); the president of the JAS; the chairman of the Jamaica Social Welfare Commission; the chairman of 4H Clubs; the Commissioner of Lands; and the Principal Assistant Secretary of the Ministry of Agriculture and Lands. This committee was charged with essentially the same functions as those previously specified for the 1951 review. In 1959, a parliamentary secretary replaced the director of Extension Services as chairman of the Coordinating Committee, and the membership of the committee was expanded to include representatives of the Sugar Industry

Labour Welfare Board, the Agricultural Credit Board, the Forest Department, the Department of Cooperatives, and the Lands Authorities.

In 1964, the Extension Service was again reorganized in order to separate educational services from administration of government programs. Two separate services were established under the director of Extension; extension officers were charged with providing educational services, and development advisory officers were made responsible for supervising programs such as the Farmers' Development Scheme, the self-supporting Farmers' Development Program, and the Agricultural Credit Schemes.

In 1969, the Ministry of Agriculture and Lands was split into the Ministry of Agriculture and Fisheries and the Ministry of Rural Land Development, with a concomitant transfer of staff and functions between the two. In 1972, the two ministries were rejoined to create the present Ministry of Agriculture, in which the Extension Service currently resides. Extension is at the present time in the final stages of another reorganization based upon recommendations of an FAO/IDB study. The government has never been fully effective in unifying all extension activities under a single national extension service, and various commodity boards and other organizations continue to operate small quasi-extension programs for special clientele groups.

Extension Institutional Structure

At present, several Jamaican organizations provide non-formal agricultural education to rural people, including three MINAG offices (Production-Extension Department, Research and Development Department, and the Training Division). Ultimately, educational services provided

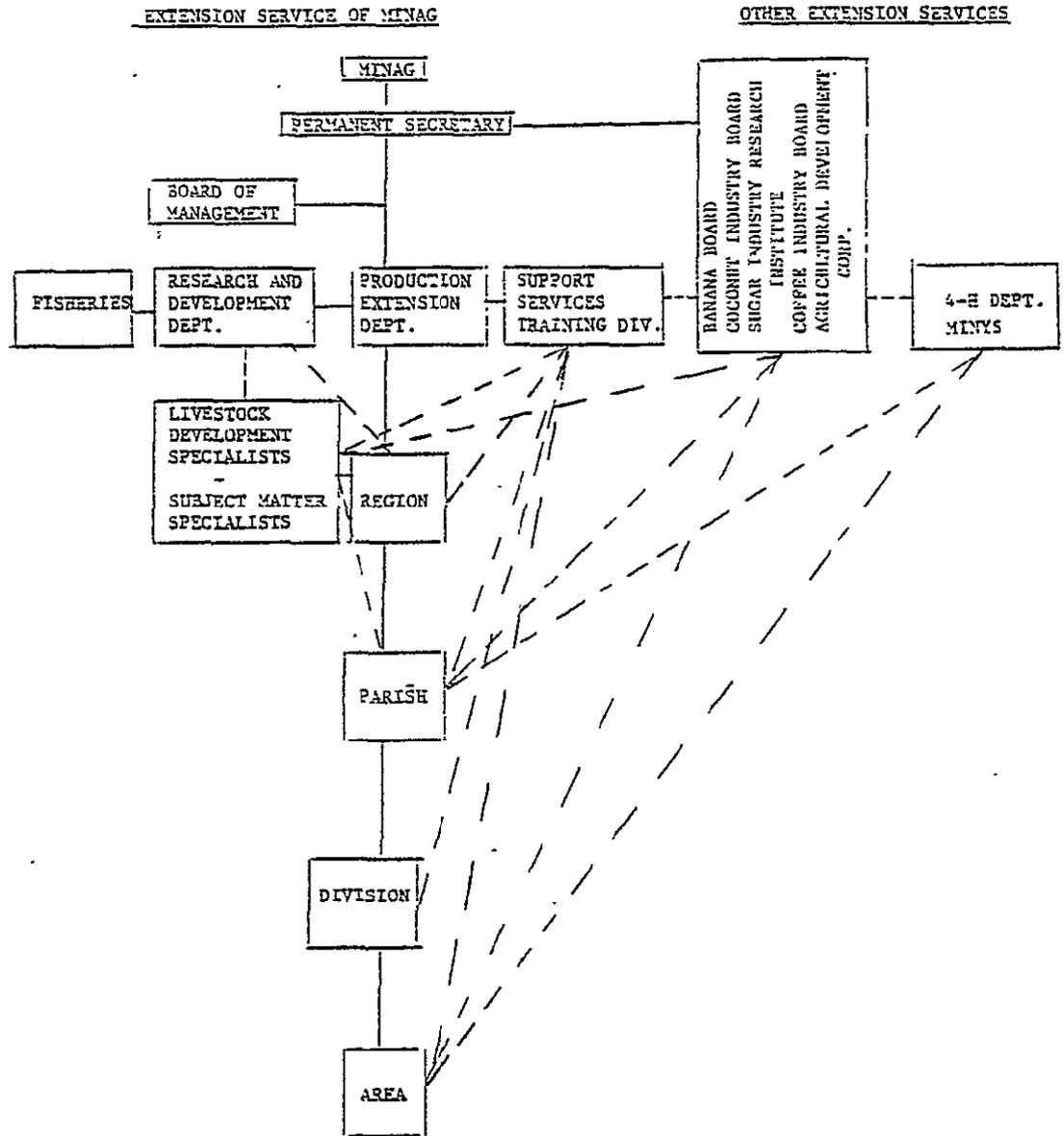
by the commodity boards are to be taken over by MINAG, but presently four boards continue to offer some extension services: Banana Board, Coconut Industry Board, Sugar Industry Research Institute and Coffee Industry Board. MINAG has absorbed the services previously provided by the Cocoa Board and the Citrus Board. In addition, the Agricultural Development Corporation provides some educational services in the area of livestock production, and the Ministry of Sport and Youth organizes 4-H clubs. Figure 4.3.1 delineates the structure and organization of the various extension programs.

Production Extension Department. The primary extension organization in Jamaica is the Production Extension Department of MINAG. It is structured into five levels including: a national office called the Production Unit, 4 regional offices, 13 parish offices, 65 divisional offices, and 401 area offices. Figure 4.3.2 shows the structure of MINAG's extension services.

The Production Unit directs, controls and coordinates the work of the regional, parish, division and area extension offices and ensures continuing linkage between the Minister, the Permanent Secretary, the regional director and other services of the Ministry by:

- reviewing and formulating policies and plans;
- monitoring, evaluating and accounting for performance and progress;
- allocating resources and services among the regional offices;
- expediting on-going activities and clearing bottlenecks;
- handling affairs of national significance and accounting for all programs/projects at the national level.

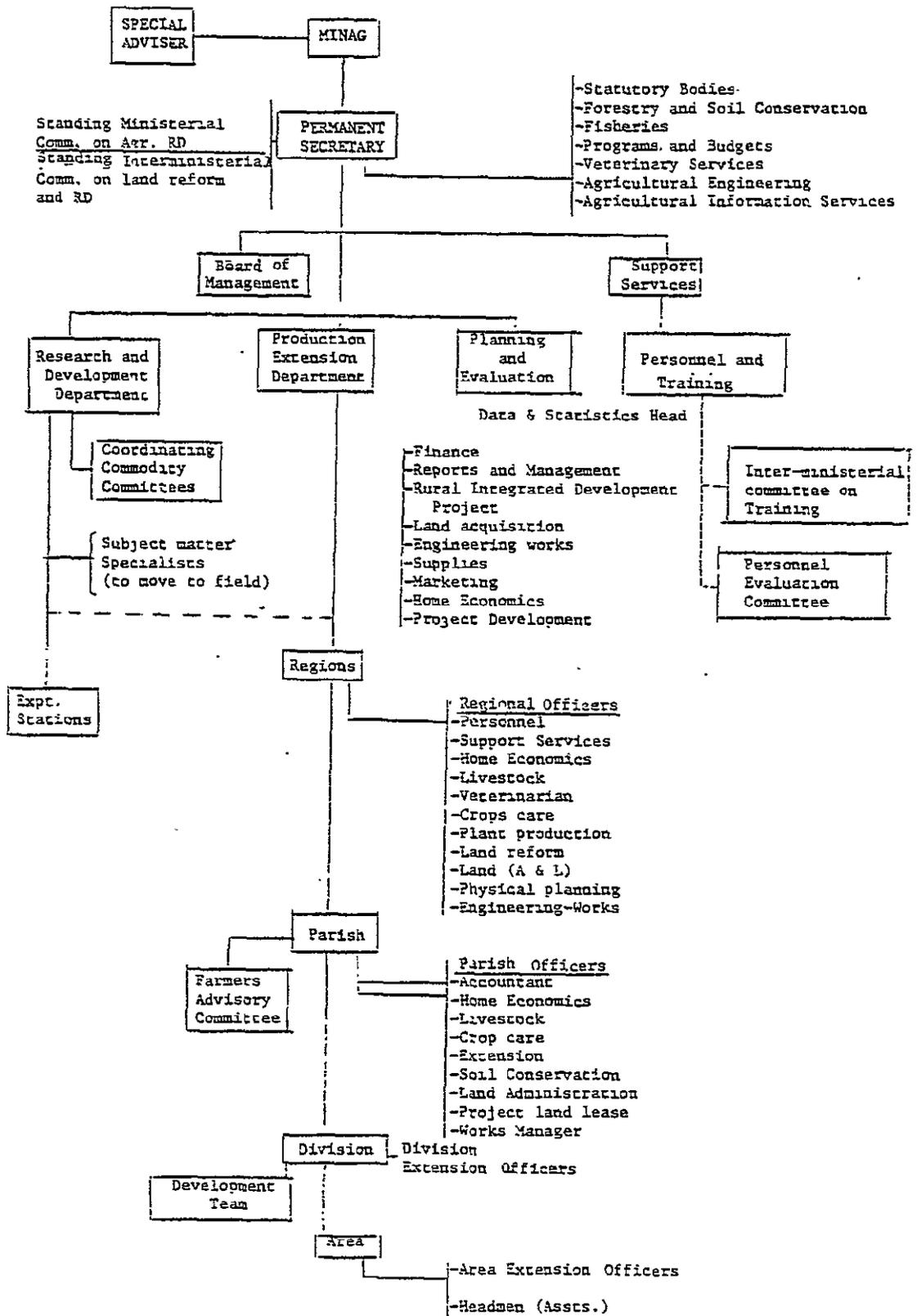
ALL EXTENSION INSTITUTIONS



--- = The dotted lines indicate linkages

Figure 4.3.2

EXTENSION PRODUCTION UNIT-BASIC LINKAGES IN MINAG



The Production Unit is composed of a multi-disciplinary team responsible for maintaining continuous contact with the regional/parish staff to provide technical backstopping and monitoring. It acts as intermediary between the regional offices and finance, planning, personnel and other central management offices. The plans for the department include the introduction of a structured management system utilizing a production target approach to development. There is to be a monthly reporting system from the divisional and area offices up through the parish and the regional offices to the department, accounting for the amount and rate of expenditure against financial targets and which identifies and explains problems and failures in a continuing attempt to overcome them. Program planning is to be initiated at the area and divisional levels and will be consolidated into parish plans. These in turn are to be consolidated into regional development plans. The department director and his staff hold bi-monthly meetings with the regional directors and discuss how best to coordinate efforts in carrying out field programs.

Regional directors have broad executive powers for implementing programs and projects under the direction of the Production Unit. They have principal responsibility for the management of agricultural development programs and projects and liaison and coordination with other key activities in the region, e.g. research and development and credit and marketing (AMC). Thus, they serve as the main vehicle for the provision of efficient, decentralized and strengthened programs to the farmer.

Together with their deputy regional directors, regional directors preside over the following areas, each headed by a regional officer:

- Property Administration, Valuation and Acquisition

- Land Settlements
- Project Land Lease
- Pioneer Farms
- Crop Production
- Plant Production
- Livestock Production
- Veterinary Services
- Crop Care
- Home Economics
- Engineering and Works
- Soil Conservation
- Rural Planning

In addition, when clearly defined projects (such as the Rural Development Project funded by AID) which encompass one or more parishes in the region are to be implemented, regional project units headed by a regional project manager are established in the regional office. The regional project manager heading a unit is directly accountable to the regional director and has control of all project activities during the implementation/construction phase. Upon project completion, these units cease to exist.

As the agency providing a broad spectrum of services to the parish farming community, each parish office is the focal point for agricultural development in the parish. In particular, it

- plans, services, directs, and implements parish and local agricultural programs and projects;
- provides data and information necessary for regional and central direction, control and planning;

The parish office is directed by a parish manager and deputy parish manager. Several professional staff members work under their direction.

Parish farmers' advisory committees meet monthly to consider local progress and problems and to scrutinize and monitor the plans, programs and projects for the parish. These committees provide guidance to the parish manager in terms of meeting the needs of farmers. The parish manager, in turn, is responsible for ensuring coordination and cooperation with other community representatives and organizations such as community councils, parish councils, parish production committees, and local members of parliament. This aspect of the parish manager's duties is particularly important since other formal participation and coordination of local government and community institutions in agricultural development is singularly lacking.

In most parishes, there are two divisions and, therefore, two divisional extension officers. The divisional officer supervises the divisional program and the work of the area extension officers, and serves as liaison between the area and the parish. He links the resource persons of the parish with the needs of the division.

The area extension office, the grassroots level of extension's administrative hierarchy, serves approximately 500 farmers. The area officer forms the direct and immediate contact point with the farming community. He serves as a technical advisor, and provides assistance with farm planning, credit, and production input. He is the link with all of the technical services provided at the parish level.

Research and Development Department. For quite some time, some aspects of livestock extension work have been administratively separate from the Extension Service. Livestock development officers, who are

administratively linked to livestock research in the Research and Development Department, have provided extension services to large farmers, in-service training programs for Extension Service personnel, and have participated in training programs for small farmers. This organizational model is now being adopted for all extension subject-matter specialists, including crop specialists who heretofore have been employed directly by the extension service. In the future, all such specialists will come under the Research and Development Department and will be located at the various research stations.

The development officers' major function will be an information conduit between the extension staff within the Production-Extension Department and the research staff. This will be accomplished through such specific activities as organizing in-service training programs for extension personnel, assisting extension in the establishment of demonstration plots, presenting talks to groups of farmers, and assisting research officers in field testing of new methods and practices on farms.

Training Division. The Training Division of MINAG, using suggestions emanating from administrators, specialists, and field extension staff of MINAG, organizes training courses for staff and farm groups. During FY 1979, the Training Division organized 19 in-service courses for 435 extension personnel. Seminars were conducted on various subjects, including extension methods and management, agricultural production methods, and rural home industry. A staff of six professionals administers the training program.

4-H Clubs. Another extension activity is 4-H club work. In 1978, the 4-H program consisted of 632 clubs, reaching 39,278 youths with the

support of 2,198 leaders. The program is organized by 19 staff members of the Ministry of Youth and Sports. Projects illustrative of 4-H club activities include work with livestock, crops, crafts, and campaigns on rat control, and are conducted primarily at the parish and area levels in cooperation with parish and area extension officers. Extension Service officers, the boards, the Agricultural Development Corporation, and the 4-H Department provide assistance in organizing major events such as 4-H training week, achievement days, and the Denbigh Agricultural Show held nationally each year.

Agricultural Development Corporation. The Agricultural Development Corporation is responsible for the operation of government-owned estates, particularly livestock operations. Although it has no formal responsibility for extension activities, it does respond to individual requests for technical advice and sponsors frequent farm tours on its estates. It has no specific budget for extension programs and has not designated any staff with extension responsibilities. Nevertheless, along with MINAG's livestock development officers, it is a major source of livestock extension work, particularly for swine.

Statutory Boards. Although it is now government policy that all extension services are to be transferred to MINAG, four statutory commodity boards currently maintain extension programs. No specific dates have been designated for the transfer of these activities to MINAG. These boards maintain a staff of approximately 100 professionals to work with the producers of four major export crops (sugar, bananas, coffee, and coconut). The extension programs in citrus, cocoa, and pimento are now operated solely by MINAG.

With the exception of sugar, however, MINAG and the boards cooperate extensively in providing extension programs to the producers of the export crops. MINAG and the boards organize collaborative educational programs and seedling distribution programs; literature prepared by the boards is published and distributed by MINAG; and demonstration field days and disease and pest campaigns are jointly organized.

Conclusions. Over the past three decades the organization of extension has frequently been revised, seeking to (a) consolidate the activities of the various organizations providing extension services and (b) to better assist small farmers. Inevitably this has created inaccuracy and confusion among extension's personnel and clientele. Given that the currently purposed restructuring appears to potentially meet these objectives, it would be advisable to complete the reorganization and then allow a lengthy period of operation to permit a full testing of the organization while at the same time strengthening its capacity to fulfill its mission.

Extension Resource Allocations

Methods for Allocating Resources. The Ministry of Agriculture and the statutory boards make no attempt to record the distribution of their resources either by crop or clientele group. Hence, in the preparation of this study it was necessary to make rough estimates of this distribution on the basis of data derived primarily from interviews. Recurrent extension expenditures of MINAG were derived from the GOJ publication, Estimates of Expenditures. Recurrent expenditures for 4-H activities were found in the same source. Recurrent expenditures of the Coffee Industry Board were obtained by interview. The Coconut Industry

Board only provided data for 1978. Hence, it was assumed that 1973 expenditures were 50 percent of the 1978 level, reflecting the same percentage growth as that of MINAG. The Banana Board and Sugar Industry Research Institute did not provide any expenditure data but did report 1978 personnel numbers. Rather than omitting these organizations in the calculations, MINAG's 1978 expenditure per professional (JA \$15,000) was multiplied by the number of personnel employed in order to obtain an estimate of expenditures for 1978. Again it was assumed that 1973 expenditures were 50 percent of 1978 levels as experienced by MINAG.

Personnel levels were obtained through a combination of interview and MINAG file data. No data were available for capital expenditures because capital expenditures for extension services are aggregated with the costs of specific programs and projects, and no satisfactory method could be found to separate these in the time available to the study team. However, it is apparent that some significant capital investments were made during the five years in question.

In order to allocate the distribution of MINAG expenditures and personnel by subject-matter, estimates supplied by extension personnel of the relative percentages of their time devoted to these subjects were averaged after deducting non-extension activities (administration of credit and subsidy programs). It was assumed that 4-H personnel allocated their time in the same fashion as MINAG extension personnel, and all expenditures and personnel of the statutory boards were assumed to be devoted to export crops.

The distribution of MINAG extension personnel and expenditures among farm size classes was also based on interviews of selected MINAG workers, and averages were computed of their estimates of the percentage

of time allocated among the five farm-size categories in 1973 and 1978. These percentages were then multiplied by total expenditures and personnel to derive expenditures and man-years allocated to each farm size classification. Lacking a more accurate method, 4-H budget and personnel were allocated utilizing the coefficients derived from the extension service.

The method used to allocate research personnel and expenditures by farm size was also followed in allocating extension expenditures and personnel of the statutory boards, i.e., expenditures and personnel of each board are distributed in proportion to the acreage of the relevant crop held by each farm size class in 1969.

Undoubtedly, the estimates summarized in Table 4.3.1 understate Jamaica's total extension expenditures and personnel. In addition to the inability to estimate capital expenditures, a further problem arises in that recurrent expenditures of the Agricultural Development Corporation and MINAG's livestock development program could not be included. Moreover, the estimates for the statutory boards are in all likelihood on the low side. The result is that the proportion of expenditures devoted to export crops, livestock, and large farms is underestimated while the proportions estimated for domestic crops and small farms is overstated.

Extension Personnel and Expenditure Allocations. Jamaica allocates a substantial amount of personnel to provision of extension services. Even after deducting the 140 personyears devoted to administration of credit and subsidy programs, 485 personyears are devoted to non-formal agricultural educational services (See Table 4.1.1). This is equivalent to about 400 farmers per extension person-year, a relatively low

Table 4.3.1. Extension Manpower and Financial Investments by Subject Matter, Client Groups, and Function

	Personnel (man-yrs)	1973 Expenditures		1973 Percent of Expenditures	1978 Expenditures		1978 Percent Expenditures
		Current	Capital		Current	Capital	
1. Subject Matter Variables							
A. Resources	26.3	269,430		6.8	401,511		5.4
1) Natural							
2) Technical							
B. Commodity							
1) Export Crops	120.5	1,077,216		27.4	1,931,071		25.8
2) Domestic Crops	163.4	1,264,249		32.1	2,494,492		33.3
3) Livestock	28.0	302,591		7.7	427,139		5.7
4) Fish	24.1	174,088		4.4	367,340		4.9
5) Forestry	18.5	149,223		3.8	281,912		3.8
C. Socio-Economic							
1) Farm Mgt. & Oper.	38.7	236,270		6.0	589,452		7.9
2) Marketing & Dis- tribution	31.9	190,674		4.8	486,939		6.5
3) Social & Cultural	15.1	132,643		3.4	230,655		3.1
D. Public Policy	18.5	140,933		3.6	281,912		3.8
TOTAL	485	3,937,317		100.0	7,492,421		100.0

Table 4.3.1 (cont'd)

	Personnel (man-yrs)	1973 Expenditures		1973 Percent of Expenditures	1978 Expenditures		1978 Percent Expenditures
		Current	Capital		Current	Capital	
II. Client Group Variables							
1) Landless (0-.9 acre)	83.4	660,186		16.8	1,274,191		17.0
2) Small (1-4.9 acre)	132.1	1,076,690		27.3	2,031,909		27.1
3) Medium (5-24.9 acre)	148.0	1,213,989		30.8	2,282,179		30.5
4) Medium Large (25-99.9 acre)	62.3	498,712		12.7	957,521		12.8
5) Large (100 acres & over)	59.3	487,740		12.4	946,620		12.6
TOTAL	485.0	3,937,317		100.0	7,492,421		100.0
III. Functional Variables							
A. Extension							
1) Natural & Physical Science	390	3,307,264		84.0	6,044,419		80.7
2) Social Science	95	630,053		16.0	1,488,002		19.3
TOTAL	485	3,937,317		100.0	7,492,421		100.0

farmer-extension worker ratio for an LDC. Furthermore, the aggregate level of expenditures for extension in Jamaica is remarkably high for a less developed country. The estimated budget of JA \$7.5 million amounts to almost JA \$40 (U.S. \$22) per farm, or 1.5 percent of gross agricultural revenues.

The distribution of personnel and expenditures among subject matter areas is also surprisingly reflective of their relative importance. It appears that only livestock and socio-economic education receive a somewhat low allocation. The low estimate for livestock in part reflects a lack of data rather than an actual lack of expenditures.

The number of personnel providing extension services could be increased by approximately 29 percent through the transfer of responsibilities for subsidy and credit programs to personnel trained for that purpose rather than utilizing agriculturally trained workers. This would result in a farmer to extension worker ratio of approximately 250 to 1. It would also help clarify the role of the extension worker as an educator and would facilitate the provision of educational services.

Table 4.3.2 provides data for contrasting the importance of the various farm size categories with the distribution of extension personnel and expenditures among the farm sizes. The largest farms (100 acres and more) are allocated a much larger proportion of extension resources than their importance as measured by number of farms. However, when comparing share of resources with share of acreage and share of revenues, the large farms receive a relatively low proportion of extension resources. The inverse is true of the smaller farms. Although the landless represent less than 30 percent of all farms, control only 1.5 percent of the land in agriculture, and produce only 8.6 percent of

revenues, they command approximately 17 percent of extension resources. Small farms receive a percentage of extension resources approximately equal to their importance as measured by revenues. It is the medium and medium large farms which receive the most extension services relative to their importance. Their share of extension resources exceeds their representation as a percentage of farms, acreage, and revenues.

This distribution appears fairly consistent with addressing the dual objectives of equity improvement and an improved trade balance. There appears to be some bias towards medium and medium-large farms relative to the small, probably reflecting the historical structure of extension programs. A redistribution in favor of the small farmer is current government policy, and may be achieved through centralization of extension services.

Physical Facilities, Equipment, and Materials

Interviews with extension staff members revealed a surprisingly consistent rank order of the offices in need of improved physical facilities, equipment, and educational materials as follows: division (and area); training centers, parish, Agricultural Information Center, region, and Production Extension Unit.

Division and area offices frequently lack adequate office space and supporting equipment, and the inadequacy of transportation for field visitation of extension officers constitutes a particularly serious problem. In terms of budget allocations to extension, first priority should be assigned to physical plant, vehicles, and equipment.

The second level of priority is the four training centers, where almost all in-service training is conducted. These centers include

Kenilworth in Hanover; Canaan in St. James; Eltham in St. Ann; and Twickenham in St. Catherine. Existing facilities include a general classroom, dormitory, and home economics classroom at each of the centers with the exception of Kenilworth. The physical facilities at Canaan are presently being upgraded with technical assistance from the Dutch government. Staff members are required to stay from one day up to three weeks during training and are group-housed in dormitories with sleeping accommodations in double and triple deck bunk beds. Because of the inadequacy of these arrangements, many officers resist participation in training programs. There is a need for single beds separated at least by cubicles which would provide some degree of privacy. There is also need for expanded classroom space to accommodate larger groups. Other physical needs include office equipment, audio-visual equipment and materials, farm equipment for demonstration (e.g. spray pumps, soil augers), home economics facilities (e.g. stoves, cooking utensils, sewing machines), and buses or other vehicles suitable for transporting large groups.

At the parish level the major needs are for storage space, equipment, and educational materials. The equipment needed in almost all parishes includes visual aids (slide projectors, screens, cameras) and duplicating facilities to reproduce educational materials for distribution to the divisional officers. Also needed is a small library facility or other space suitable for storage and exhibition of publications for farmer, family, and community use.

The Agricultural Information Service (AIS) is the source of published technical information such as pamphlets and leaflets. However, AIS lacks adequate equipment for audiovisual presentations and for

printing services.

The regional offices are a recent creation. Visits to three of the four offices indicate that they have the most modern and adequate physical facilities, the newest government vehicles, and the best duplicating equipment. They also have a staff of technical field officers in a variety of subject matter areas who can produce needed educational materials. The major need at this level is for facility and equipment maintenance and for a greater supply and quality of educational materials coming from the Agricultural Information Service. Since the region is the center for planning, coordinating, and administering the total extension programs, there was also an expressed need for a regional library and training center in each region.

Ranking last in terms of need is the office of Production Extension Unit. This office functions primarily as an administrative, planning, monitoring, and controlling unit. Its physical facilities and equipment are adequate compared to other units of the organization, although there is a need for more modern recording and transcribing equipment in order to modernize the operation and enhance its efficiency.

Institutional Linkages

Linkages among domestic extension groups, both formal and informal, represent a wide range of intensity. Table 4.3.3 summarizes the interactions of these groups. Extension MINAG and the extension staff of various boards -- Banana, Coconut Industry, Cocoa, Coffee -- and the Citrus Growers Association work together within special subject matter areas. The intensity of interaction ranges from sharing literature and staff meetings to close cooperative undertakings in research trials,

TABLE 4.3.3. EXPANSION INSTITUTIONAL LINKAGES

	R & D Livestock Dev. Spe- cialists	R & D Crops Dev. Spe- cialists	Production Extension Dept.	Support Services Training Div.	Banana Board	Coconut Industry Board	Sugar Industry Research Institute	Coffee Industry Board	Fisheries	4-th Dept. MINAG	Agr. Dev Corp.	Forestry
Landless Farmers		x	x	x		x						
Small Farmers	x	x	x	x						x		
Medium Farmers	x	x	x	x						x	x	
Med. Large Farmers	x	x	x	x						x	x	x
Large Farmers	x	x	x	x						x	x	x
Jamaican Agric. Society	x	x	x	x						x	x	
Growers' Associations	x	x	x	x								
Agricultural Cooperatives	x	x	x							x		
Research and Dev. Dept. MINAG			x	x	x						x	
Banana Board	x	x	x	x						x		
Coconut Industry Board	x	x	x	x	x			x				
Cocoa Board	x	x	x	x		x						
Sugar Industry Board	x	x	x	x						x		
Coffee Board	x	x	x	x								
Citrus Growers Association	x	x	x	x								
Agro-Industries	x	x	x	x						x	x	x
Peoples Cooperative Bank	x	x	x									

Cont'd.../Agricultural Credit Board

Table 4.3.3
Extension Institutional linkages (Cont'd)

	R & D Livestock Dev. Spe- cialists	R & D Crops Dev. Spe- cialists	Production Extension Dept.	Support Services Training	Banana Board	Coconut Industry Board	Sugar Industry Research Institute	Coffee Industry Board	Fisheries	4-II Dept. MINED	Agr. Dev. Corp.	For- entry
Agricultural Credit Board			x									
Agricultural Marketing Corp.	x	x	x	x								
Educational Institutions			x							x		
Vocational and Technical Schools			x	x						x		
Jamaica School of Agriculture			x									
Agricultural Development Corp.	x											
CAST			x	x								
UWI - Mona			x	x	x	x	x					
Public Works Dept.			x									
Social Services Commission			x									
IADB			x									
World Bank		x	x									
IICA			x		x			x				
CARDI	x		x		x		x					
FAO						x						
European Development Fund			x	x								

Cont'd.../UWI Trinidad

Table 4.J.3
 Extension Institutional Linkages (Cont'd)

	R & D Livestock Dev. Spe- cialists	R & D Crops Dev. Spe- cialists	Production Extension Dept.	Support Services Training	Banana Board	Coconut Industry Board	Sugar Industry Research Institute	Coffee Industry Board	Fisheries	4-H Dept. MINED	Agr. Dept. Corp.	For- estry
UWI Trinidad	x		x	x			x					
USAID	x		x	x		x						
USDA	x		x				x					
US Peace Corps	x		x	x								
GVS	x		x	x								
Bilateral Donors, Japan, etc		x	x	x								
Fisheries			x									

demonstrations, farm tours, and field days.

Within MINAG, the Department of Research and Development (R&D) and the Production-Extension Department (PED) have joint responsibility for interpreting research findings to the farmer through educational meetings, demonstrations, and other means. Currently, R&D is being reorganized to include an expanded extension responsibility. R&D and PED plan to unify their efforts through sixteen national commodity committees, each consisting of one specialist, one extension officer, and one farmer representative. Joint efforts are also planned between development officers of the Research and Development Department and extension officers at the regional level to insure speedy transfer of research findings to farmers.

Complementing existing technical extension programs is the joint effort of the staffs in Extension MINAG, the Agricultural Credit Board, and the Peoples Cooperative Bank to provide agricultural credit. Staff of Extension MINAG, the Agricultural Marketing Corporation, and various boards also cooperate in efforts to explain credit, subsidy, and marketing programs. The staff of the Agricultural Development Corporation and Extension MINAG jointly sponsor educational meetings and special events which promote livestock production, e.g. the Denbigh Show.

Extension MINAG also cooperates with the staffs of primary, secondary, and all-age schools in educational projects, especially gardening. Extension MINAG helps to identify and refer capable students to vocational and technical schools and to the Jamaica School of Agriculture.

The Training Division of MINAG has had the cooperation of staff members of the College of Arts, Science, and Technology of the University of the West Indies - Mona Campus, and of the statutory boards in

providing in-service training to extension staff.

Extension MINAG and the staff of the Social Services Commission work together in finding appropriate jobs for the Jamaican Youth Corps.

Linkages with international groups vary in number and intensity of contacts. Extension MINAG has shared information and co-sponsored seminars on development with IICA; the Jamaican office of CARDI provides research results which are shared with extension staff; FAO has provided a team to survey the damages caused by recent flooding and has consulted with Extension MINAG in drawing up proposals which may be financed by the United Nations Development Fund; the IADB is funding the reconstruction of several retail parish markets, a project which has had Extension MINAG support as well as the support of several domestic groups.

Through the European Development Fund, members of Extension MINAG staff receive a limited number of scholarships for overseas study. Extension MINAG and various bilateral donors cooperate in a variety of projects including engineering projects, tank construction (German Voluntary Services), the Elim Rice irrigation project (Japan), and a number of micro dams (Italy).

Extension MINAG has excellent linkages with the United States Agency for International Development (USAID) and with the United States Peace Corps. Extension MINAG is involved with USAID on several projects, the principal one being the Integrated Rural Development Project in Two Meetings and Pindor Rivers area, and has also worked with the U.S. Peace Corps on a variety of projects.

Incentives^{1/}

It is generally recognized that any successful organization must provide incentives and rewards for superior performance and must provide opportunities for professional improvement of its staff. The three main components of such an incentive program are: (i) salary scale and promotional structure, (ii) program support, and (iii) professional improvement programs.

Salary Scale and Promotional Structure. Extension Service MINAG staff members are Civil Service employees and the salary scale in 1977-78 was as follows:

1. Senior Management Group (SMG) Grades I, II and III. Salaries ranged from J\$13,800 to J\$17,640.
2. Natural, Physical and Social Science Group (NPS) Grades I, II, III and IV. Salaries ranged from J\$9,000 to J\$13,080.
3. Program Management and Administration Group (PMA) Grades I, II, III, IV and IVA. Salaries ranged from JS7,420 to J\$13,120.
4. Practical Science and Technology (PST). Salaries ranged from J\$5,800 to J\$9,340.
5. Technical Support Services Group (TSS) I-VIA wages are paid weekly and range from J\$59 upward. Headmen can earn up to J\$10,000 and become salaried up to J\$11,040.

Extension personnel are generally categorized within the groups and grades as follows:

^{1/} Information derived from Civil Service Establishment Act, Order 1978, and from interviews with Extension personnel, especially the Training Division.

1. In the MSG are included administrators from regional director to production unit director.
2. In the NPS Group are degree-holding professionals -- from recruits to senior officers, including deputy regional extension directors, subject matter specialists, and department heads.
3. In the PMA Group are parish and assistant parish managers.
4. In the PST Group are division and area extension officers.
5. In the TSS Group are extension headmen and weekly-paid clerical, secretarial, and other staff.

Salaries increase by group and grade from TSS upward to SMG. Some salary schedules overlap.

The promotional path normally involves transfer from area to division, to parish, etc. Promotion within a position is uncommon, although some increase in grade is feasible. Performance evaluation of all extension personnel is carried out annually, but this procedure is a recent innovation. Funds for salaries are distributed in accordance with ratings received in the performance evaluation.

Program Support. A second motivating force for staff efficiency and increased staff productivity is program support, including the physical plant, vehicles, equipment, and materials and supplies needed to carry out an effective program.

At the national and regional levels, the physical plant is considered to be generally adequate. However, division and area office physical facilities are inadequate, as are some parish offices.

Although the government provides an interest-free loan program to assist extension staff members to purchase personal vehicles for

business use, pays a reasonable price per mile driven, and also provides some vehicles for extension field use, there is still a serious shortage of transportation. The shortage of transportation is in the past explained by lack of funds for the loan program and limits on the budget for mileage. Recent surveys (1977-78) conducted within MINAG show that 459 field staff, including 315 area extension officers and headmen, lack adequate access to transportation.

Interviews with field staff also indicate a serious need to expedite the flow of educational materials and supplies to the field staff. The interviewer asked the following questions relative to program support: (i) "In general, do extension personnel receive adequate supplies of equipment and materials when needed?" and (ii) "Are there shortcomings or inadequacies in the incentives used by extension? If yes, what are the shortcomings and how may they be resolved?"

With interviewees, other than administrators, the answer to the first question was "no"; the answer to the second question was "yes." The answer to the first question was often followed by a comment indicating there was also a shortage of equipment and materials. Shortcomings may be summarized in one statement, "Information is too often late in reaching the field." Interviews also revealed a serious shortage of equipment essential to the production of bulletins, leaflets, and other materials even though the Agricultural Information Service has made good arrangements with commodity boards and other agricultural groups to share the cost of producing publications.

Professional Improvement. Support for professional improvement is one means of raising skill levels and increasing productivity. The two main elements in extension professional improvement in Jamaica are

in-service training and overseas study.

Most in-service training is conducted by the Training Division of MINAG. Ideas for training originate with subject matter specialists, administrators, or filter up from the areas through the regional directors to the Extension Production Department and are passed on to the Training Division. The Training Division consults with relevant subject matter specialists to determine course content, length of course, time, and site location for the training. In conjunction with the Extension Production Department, the Training Division decides who will participate in the training. During FY 1978-79, the Training Division of MINAG reported that 31 in-service training courses were conducted, with an attendance of 725 staff members. Courses vary in length from one day orientations of new staff to training on concepts of working with rural people and project profile preparation for divisional and area extension officers which require up to two weeks. Most of the training courses, however, last four to five days and cover such subjects as improved practices in coconut production, data collection, management organization, rice expansion, cassava production, and hillside farming. The training program is designed to provide in-service training to each staff member each year.

The Ministry of Public Service, through its Division of Management Development, is primarily responsible for overseas study. With the assistance of an inter-ministerial committee which reviews and approves or disapproves the candidates, the Division of Management administers the scholarship program. The Training Division of MINAG assists by providing information on extension candidates.

During FY 1978-79, Extension MINAG staff participated in several overseas study courses which ranged from less than one week up to one year.

Courses of less than a week's duration were on training methods for managing cooperatives (held in the United Kingdom); on sugar cane feed (held in Trinidad); and on multi-sectional nutrition planning and project implementation (held in the Philippines).

Courses of one week to a month's duration included diagnostic techniques in poultry research (held at the University of Georgia, U.S.A.); and development administration (held in Barbados). Programs of one to six months duration included

1. Courses conducted in the United Kingdom on planning and appraisal of agro-industry projects, cooperative management and administration, and horticulture.
2. Courses conducted in the U.S.A. on cooperative education and management (University of Wisconsin); international agricultural marketing (University of Colorado); bovine mastitis control (Cornell University); and tropical fresh water fish culture (Auburn University).
3. Two courses in Israel on comprehensive regional development, beekeeping, and extension methods.
4. Other courses included agro-industrial management (Brussels); an agro-industrial project (Barbados); soils studies (Trinidad); and management of agricultural development (Swaziland).

Participation in the above training courses was limited. Two persons participated in each of three training courses--management of agriculture development, sugar cane feeds, and tropical water fish

culture. Only one person from extension participated in each of the other courses, and one staff member received leave for a year to study plant pathology at Reading, England. In all, 27 persons participated in the overseas study program.

Extension personnel may also undertake self-financed overseas study, and over the years several extension staff members have taken advantage of the opportunity for advanced study in the United States. To qualify, the candidate must first obtain written acceptance at an overseas institution, must be recommended by the Training Division of MINAG, and must meet the qualifications set forth by the Public Service Commission.

Overall, the Ministry of Agriculture's incentives for self-improvement and job performance are rather weak. Although it is possible to obtain salary increments through outstanding performance, these have lagged well behind the inflation rate. Moreover, promotion is slow since there are few higher level jobs relative to the number of candidates at the next lower level. Also, superior performance is constrained by the lack of supporting resources and the very broad responsibilities assigned to individual workers. Opportunities for professional training (particularly foreign training) are limited by foreign exchange constraints.

Public Service Orientation

One way to assess a government's public service commitment is to study its statements of philosophy, strategies, and goals, and follow this with a review of actions taken.

In the Green Paper No. 2 on "Agricultural Development Strategies" signed by the Minister of Agriculture in 1973, the following goals were identified:

1. Accord rural development-centered agriculture a greater emphasis than in the past.
2. Create a climate, within the rural setting, to enable the agricultural sector to expand output and increase production.
3. Develop a rural development strategy to enable as large a percentage as possible of the country's labor force to be retained in productive employment in rural areas.
4. Create a basic infrastructure and an integrated approach to planning for the provision of social facilities and amenities.

Five years later, in April 1978, the Minister of Agriculture enunciated the following policy goals before a group of farm leaders:

- (i) to produce as much of the raw material as is feasible to meet the requirements of: (a) adequate nutritional levels of the population, (b) agro-industry, (c) export market;
- (ii) to structure production so as to reduce reliance on imports;
- (iii) to ensure that all agricultural lands are used to their fullest potential, which will result in optimum economic and social benefits to the country as a whole;
- (iv) to increase rural income, particularly farm income;
- (v) to improve rural amenities and social infrastructure as a basis for raising the standards of living of rural people;

- (vi) to provide more employment opportunities so as to reduce unemployment and under-employment.

These two sets of policy statements show consistency and compatibility in terms of government public service goals for agriculture. In the past few years, government action has resulted in the spending of millions of dollars on accelerated land reform programs, expanded irrigation acreage, improved efforts in marketing, expansion of agricultural credit, development of a series of subsidy programs, and other similar projects. Plans for integration of activities have resulted in a rural development project in Western Jamaica and in the recently initiated Integrated Rural Development Project of the Southern Region in the area of Two Meetings and Pindars River.

In an effort to realign its personnel resources for possible greater service to farmers, particularly small farmers, the research and extension units have been reorganized. Extension has been decentralized, with greater authority and emphasis being placed at the regional, parish, division, and area levels. Staffing of the lower two levels of the organization has been greatly strengthened and now totals 65 division officers and 401 area officers. This suggests a strong government effort to provide greater public service to rural Jamaica.

A non-statistically verifiable survey conducted in the field among extension workers suggests that there is in fact an awareness of the government policy to strengthen service to rural communities. Respondents were generally familiar with official statements and efforts to implement new programs. Individuals appear to be dedicated professionals who are sincerely interested in getting the job done and are working towards that end.

Critical Mass of Trained Professionals

In 1978-79, the academic training of the Extension MINAG staff was as depicted in Table 4.3.4. Two staff members held Ph.D.'s in plant pathology and five had received M.S. degrees (three in agronomy, one in agricultural extension, and one in home economics). Thirty-two staff members held B.S. degrees, with only one in home economics, one in sociology, and one in education. The other 28 held various assignments.

With the exception of two persons in plant pathology and three persons in agronomy, it is obvious that there did not exist enough highly trained staff members in any one discipline at any degree level above B.S. to constitute a critical mass.

With the decentralization of the Production Extension Department, interdisciplinary groups of extension officers have been or are being developed at the regional and parish levels. Because of the diversity of the geography and climate, and the complexity of the multiple cropping system of farming, there exists great need for developing personnel at these levels.

During the early 1970's the Ministry of Agriculture increased its efforts to serve small farmers. A major component of this effort was the establishment of area offices, each to provide extension services to 500 small farmers. However, trained manpower was lacking to fill all the area positions. Rather than leaving them vacant, headmen who had substantial field experience but lacked formal education in agriculture were promoted to temporary agricultural extension officers in order to fill these positions. A large number of temporary agricultural officers remain in charge of the area offices. Over time, a critical need is to

Table 4.3.4 EDUCATIONAL ATTAINMENT OF PROFESSIONAL
PERSONNEL BY SUBJECT MATTER VARIABLE

Ministry of Agriculture

Extension Staff

Skills level 1978

1. Subject matter variables	Ph.D.	M.S.	B.S.	L.B.S.	Total
A. <u>Resources</u>	.1	.3	1.5	22.9	24.8
1. Natural					
2. Technical					
B. <u>Commodity</u>					
1. Export Crops	.2	.60	2.77	40.3	43.87
2. Domestic Crops	.6	2.00	9.26	141.9	153.76
3. Livestock	-	.40	1.66	24.3	26.36
4. Fisheries	.1	.31	1.40	20.9	22.71
5. Forestry	.1	.26	1.16	16.0	17.52
C. <u>Socio-Economic</u>					
1. Farm management & Operation	.16	.50	2.26	33.56	36.48
2. Marketing and Distribution	.16	.46	1.86	27.76	30.24
3. Social and Cultural	.10	.20	.90	13.40	14.60
D. <u>Public Policy</u>	.10	.20	1.10	16.06	17.46
Totals	1.50	5.10	23.50	356.90	387.00

Table 4.3.4 (Cont'd)

Skills Level 1978

Client Groups	Ph.D.	M.S.	B.S.	L.B.S.	Total
	1. Landless Farmers (1 acre or less)	.3	1.0	4.7	71.9
2. Small Farmers (1-4.99 acres)	.4	1.5	6.7	102.4	111.0
3. Medium Farmers (5-24.9 acres)	.5	1.6	7.4	111.6	121.1
4. M. Large Farmers (25-99.9 acres)	.2	.7	3.2	48.9	53.0
5. Large Farmers (100 and above acres)	.1	.3	1.5	22.1	24.0
TOTALS	1.5	5.1	23.5	356.9	387.0

replace these personnel with adequately trained officers and in the interim to provide the temporary officers with a strong in-service training program.

CHAPTER V

RECOMMENDATIONS

INTRODUCTION

The development of recommendations by a visiting "expert" or group of "experts" can be approached in various ways. The more daring approach is for the expert to combine his intuition and experience with those specific facts which he is able to assimilate during a short visit and to then arrive at broad conclusions. The more conservative approach is to build largely upon planning which has already been accomplished, in which case recommendations tend to be both more modest and more specific and also perhaps more likely to be accepted.

In the present study, the team has elected to follow a somewhat different path but one which leans towards the more conservative approach. Numerous previous studies of many segments of the REE system in Jamaica have been conducted. These studies, some exhaustive and some rather cursory, generally include analyses of problems and offer recommendations. We have drawn freely upon these studies, and the recommendations contained in the present study are the result of an amalgamated approach which includes information derived through use of the Baseline Study Methodology, interpretations of the findings of other study groups, and the collective judgement of the team. In an attempt to verify the validity and feasibility of the proposed recommendations, discussions were held with Jamaican and USAID officials both informally and in

seminars held on July 19, July 25, December 5, and December 6. A number of the earlier recommendations were subsequently modified on the basis of these discussions. Although the team now feels relatively comfortable with its recommendations, formal approval by either the Government of Jamaica or USAID is not implied.

These recommendations must be considered within the context of the present situation and its derivation. In terms of present capabilities, problems, and needs, the present situations in research, education, and extension exhibit significant similarity:

1. Each sector has well-trained, knowledgeable, and dedicated individuals. These are usually in leadership positions. However, the number of these individuals is quite limited.
2. REE institutions have evolved from a base which was established for purposes quite different from present national goals. For example, the main function of the Jamaica School of Agriculture was to produce middle management and technical expertise for large, usually foreign-owned enterprises. While it is generally recognized, in principle, that the needs of today are different from those of the past, attitudes and beliefs, organizational structures, and programs developed in the past still linger on.
3. To adapt to present day needs, all REE institutions are in some stage of reorganization or planning for reorganization.
4. To some degree, the programs of each of the three segments have been fragmented by attempting to accomplish more than can be achieved within present manpower and other resource limitations. Although coordination within each sector and between

sectors is less than optimal, the current reorganization should improve the situation.

5. Each sector suffers from a shortage of trained manpower.
6. Each sector suffers from a shortage of financial support.
Extension workers do not have adequate transportation; research workers lack needed supplies; and the Jamaica School of Agriculture suffers from a serious lack of operating funds.
7. The REE system lacks direction and focus at the program level. National goals for agriculture are clear, but the output needed from the REE system is far in excess of that which can currently be delivered. A sharper focus by selection, prioritization, and phasing of projects is necessary in order for each of the REE systems to meet its obligation. For example, the National Five Year Plan calls for establishing resource conserving, high production farming systems on 44,000 acres, an endeavor that will ultimately cost 50 to 100 million dollars. Some excellent research is being conducted to address the agro-economic problems of developing and installing such farming systems, but the research program is woefully inadequate to support an undertaking of this magnitude.

It should be noted that most of the conditions and problems identified herein are well recognized by Jamaican authorities. This is a strength, because recognition of the problem is the first step in solving it. It may also constitute a weakness because familiarity with a problem can breed the conviction that it is insoluble.

ASSUMPTIONS

Recommendations are always based upon certain assumptions, expressed or implicit. In this case, it is necessary to make assumptions regarding the activities that will be required of the REE system, the level of support that will be available for carrying out these activities, and the feasible rate of movement towards attainment of the desired level of activities within the REE system. It may also be useful to conceptualize a desired or "ideal" model for the system, which then becomes both an assumed desideratum and a goal towards which progress can be measured.

The main assumptions underlying these recommendations are:

1. That the Jamaican goals for agriculture remain as presently expressed, or at least are not radically altered.
2. That these goals will be pursued by the Government as rapidly as resources permit.
3. That rapid expansion of the REE resource base will not be possible in the short run, but that reasonable expansion will be possible within 3-5 years.
4. That moderate amounts of external support for the development of the REE system will be available to the Government.

Although development of a model or idealized system is beyond the scope of this study, one may, without fully describing the model, discuss important attributes of it.

The idealized agricultural education system would provide classroom and field training in the basic concepts of modern crop and livestock production to substantial numbers of prospective farmers and farm

workers. This training would be conducted in those rural schools where most farmers terminate their education. At the present, this means rural all-age schools. Agricultural subjects in these schools would be taught by teachers trained in agriculture. Rural vocational and technical secondary schools would prepare beginning level management and technical employees for agricultural production and marketing firms and sub-professional employees for the public sector. Tertiary education in agriculture would provide adequate numbers of graduates to staff new and vacant positions in extension, research support, vocational education, and other government and private enterprise activities which require agriculturally trained professionals. The government would provide opportunities for post-graduate agricultural education for tertiary agricultural teachers, research workers, specialized extension workers, and other government employees requiring such training. The various types of agricultural education would be designed so as to facilitate upward mobility and to encourage the fullest possible development of highly capable and motivated individuals.

Extension services would provide small farmers with at least one in-depth on-farm visit per year; up-to-date information on crop and livestock production and marketing practices in understandable form; field days and demonstrations at nearby locations; assistance in developing farm plans; training programs on specialized topics; advice or "trouble-shooting" on problems; and information on obtaining and utilizing credit, planting materials, subsidies, crop protection and other specialized services provided by the Ministry of Agriculture, other Government agencies, and other institutions.

Extension services for larger farmers would be similar to those provided to small farmers but would place greater emphasis on specialized information and specialized training programs, with less general on-farm advisory services. Extension programs would include:

1. a national program providing program planning consistent with national goals; primary administration of the extension activity including a logistical support system; coordination with appropriate MINAG, other government, international, and private agencies; educational materials; training programs for extension workers; specialized training programs for farmers or others involved in agricultural development; and evaluation of programs and methodology,
2. regional programs providing program leadership and direction, including integrating national goals and regional needs, specialized expertise, logistical support, training programs, supplemental educational materials, library resources, and administrative support,
3. parish programs providing program direction including integration of regional goals and parish needs, coordination with other parish agencies, logistical support, limited technical specialist services, support and coordination for demonstration and other educational programs of parish-wide interest, storage and distribution of publications, training materials, program kits, and administrative services,
4. division programs providing program development integrating the needs of the areas, administrative support, arranging cooperative programs among areas, and distribution of materials

and supplies, and

5. area programs providing primary service to farmers including consultation; delivery of educational materials; conducting workshops and demonstrations; expediting farmer attendance at training programs; calling in more specialized assistance when needed; cooperating with schools, youth organizations, farmer organizations, and representatives of other governmental or non-governmental agencies; expediting the delivery of government service to the farmer; and reporting on needs for educational or other governmental programs.

Ideally, new positions as extension officers or vacancies would be filled by B.S. or equivalent level individuals, and M.S. level training would be provided for individuals being employed or promoted to specialist positions. Means would be provided for extension officers to have adequate access to transportation suited to size, terrain, and road conditions of the area. An administrative system would be devised to encourage program development at the lower levels, with support of the program being subject to its consistency with regional or national program goals and designed to encourage, at all levels, cooperation between extension and agencies having potentially complementary or supportive roles.

The research system would be designed to:

1. establish functional linkages with international and national research centers outside of Jamaica to ensure that the fullest possible use is made of applicable research which is being conducted around the world,

2. provide adequate applied research on a broad spectrum of agricultural enterprises of importance to Jamaica in order to validate findings made elsewhere and to confirm educated guesses as to appropriate farming systems, ,
3. provide in-depth research programs to address problems of critical importance to Jamaica and for which applicable research results are not available elsewhere or are highly location specific, and
4. coordinate closely with and support programs in agricultural extension, agricultural education, and other developmental groups.

The research structure would consist of a central directorate and a relatively few regional research stations, each specializing to some degree and each designed to contain a critical mass of personnel in its field of specialization. In order to reduce the expenses for station maintenance, the number and size of stations would be held to a functional minimum, and short-term experiments would be carried out on farmer fields to the extent feasible.

Each research station would be equipped with those laboratory and field facilities necessary to its areas of concentration, and duplication would be minimized. Where possible, shared facilities would be concentrated at a central station. For example, one research library would serve as the principal agricultural library for Jamaica. Other stations would have small collections that only include the more important periodicals and reference books related to its activities but would depend upon the main library for less-frequently used publications.

All research officers would be trained to at least the equivalent of the M.S. degree level. Research officers would be assisted by lesser trained research assistants who would, if they proved to be capable, be provided opportunity for additional training and promotion. Research officers would be expected to cooperate closely with their counterparts in extension and teaching institutions, and encouraged to participate in undergraduate and post-graduate educational programs, especially thesis research projects, both as a means of strengthening these programs and as a means of assuring a supply of trained researchers. Research officers would be strongly encouraged and financially supported in efforts to maintain conversancy with appropriate research being conducted in their fields of specialization both within and outside of Jamaica as a means of increasing the use of relevant research carried out elsewhere.

Research programs would be developed within the framework of national goals consistent with the broad outline and priorities established by the research committee framework of the Research and Development Department and reviewed by the MINAG Board of Management. Specific research proposals would be developed by research officers and submitted for commodity committee and administrative approval. The program developed would concentrate in-depth research in a relatively few problem areas in order to focus sufficient effort on a given problem to have a likelihood of early payoff.

A PRIORITIZED AND PHASED PROGRAM FOR
STRENGTHENING THE REE SYSTEM

Phase I (1-3 years)

Considering the above factors and the present situation, it is clear that the initial effort should be largely limited to three areas:

1. Strengthening JSA to improve the output of trained manpower both with respect to quality and quantity. The most urgent requirement is to improve the calibre of education provided by JSA. The proposed 3-year curriculum is a step in this direction; but upgrading of faculty, development of a better program of practical training, improvement of the facilities, and continued strengthening of the management of JSA are also needed. This will require additional recurrent and capital expenditures. But this is so important to the whole REE Structure, that it must be initiated now if substantial improvement in the REE system within the next ten years is contemplated. Increasing the number of JSA graduates is of only slightly less urgency. Many positions requiring JSA graduates are vacant, and substantial improvement in the REE system as well as expansion of the services of MINAG and agro-industry will create additional needs for both JSA graduates and B.S. level graduates.
2. Strengthening the capacity of presently employed personnel through in-service training programs. Improving the REE manpower base will require upgrading the expertise of present research and extension personnel. The feasibility of this

will be limited by the shortage of training staff until the number of positions can be increased, but highly selected training programs should be undertaken. The in-service training programs of the extension service and of the extension-JSA linked training programs would be expanded as a means of staff improvement.

3. Improving management both within the REE components and through better linkages among them in order to maximize output from the present manpower and financial resources. Improving management is the subject of a number of recommendations. It includes better definition and selection of program activities, coordination, establishment of feed-back mechanisms, and provision of appropriate tools. It is focused on making better use of present resources rather than on expansion of personnel and facilities, but improved management can also require new positions, tools, or facilities.

Phase II (3-6 years)

The second phase of development would include improvement of facilities, staff expansion, and contained staff improvement as follows:

1. Upgrading and expansion of professional staff. A first priority during this phase will be to upgrade present staff through the provision of additional formal training, to replace staff through attrition with more qualified individuals, and to expand the total number of trained professional in the REE system. Area and divisional extension staff will be upgraded to the diploma and B.S. level, and the parish,

regional and specialist staff, to the M.S. level. Research staff will be strengthened by training all research workers to the M.S. level and expending the number of officers to complete staffing of the first two regional research centers and partly staff the remaining two to be constructed during this phase. Agriculturally trained teachers will be placed in the majority of rural all-age schools, and secondary education would be significantly strengthened by increasing the percentage of teachers with diplomas and B.S. degree. JSA will be strengthened by training its faculty to at least the B.S. level and half to the M.S. degree.

2. Improved REE facilities. JSA will be strengthened by construction of a new or, possibly, second campus to allow a greater number of graduates and better opportunities for practical training. Before undertaking this expansion, a determination should be made as to whether this institution should ultimately offer a B.S. degree. Plans for expansion would then be made accordingly. All-age school gardens will be improved or acquired as needed so that they can be used as effective training laboratories. By the time this phase is initiated the first two regional research centers will have been constructed and partly staffed. This phase will include constructing the remaining two regional research centers and initiation of a research library system. Improvement of extension office facilities, of training facilities and learning resources facilities in each of the extension regions, and of the mobility by extension personnel by providing more

vehicles will also be undertaken.

Phase III (7-10 years)

The third phase will involve consolidation and full use of the manpower and facilities provided in the earlier phases. By the end of the third phase, the REE system would be approaching a mature and self-sustaining system, except for continued inputs of graduate training and basic research results from outside Jamaica. The system would still be developing during this period, however, and would require:

1. continued staff upgrading in all three sectors,
2. continued efforts to develop and solidify linkages among sectors and with other Jamaican and governmental institutions,
3. expanded operating funds in order to fully utilize the increased capacity of the REE institutions,
4. obtaining more sophisticated and effective equipment which can be used by the better trained staff to implement more productive programs, and
5. expanded use of technical assistance in developing more effective programs. Technical assistance will be useful in the earlier phases, of course, but this early assistance will be expended in assisting the introduction and organization of programs, helping to develop facilities, helping in trainee selection, and training.

SPECIFIC RECOMMENDATIONS

These recommendations are discussed under the topics of General, Education, Research, and Extension. Recommendations applicable to the entire REE system are discussed under the General heading. Topics specific to a sub-system are discussed under the specific heading. Within each heading, recommendations are listed in order of priority.

General

Ge-1

Recommendation - That the presently planned structure of the REE system be maintained and tested for a period of time.

Problem - For the past 10 or 15 years, the REE system has undergone successive reorganizations as it tried to better meet the needs of the small farmer. This has disrupted programs, created inaccessibility, reduced morale, and reduced output. The most recent reorganization including the establishment of the Production-Extension Department, the Research and Development Department, the vocational agricultural schools, and the centralization of all research and extension activities within the Ministry of Agriculture appears logical and conducive to the achievement of goals.

Recommended Strategy - It is recommended that, once the current reorganization is completed, the present structure be maintained until some component proves unworkable. The present plans are workable and should be allowed to solidify and be subjected to the test of time.

The structure of tertiary agricultural education in Jamaica is perhaps less clearly in a desirable form, but it is recommended that

initial emphasis be placed on strengthening present activities and strengthening support rather than on modifying the basic structure.

It is further recommended that the more recent changes in structure and organization be explained fully to all participants in the system as soon as practical. This will reduce some of the present misinformation and apprehension.

Ge-2

Recommendation - Develop salary structures, advancement policies, and recruitment policies which favor the recruitment and retention of agriculturally trained officers in the REE system.

Problem - Turnover is detrimental to ongoing REE programs. In extension, turnover amounted to one-third of the home economics staff, about 25 percent of the subject matter staff, and 20 percent of divisional and area staff in 1978. Turnover in agricultural teachers was reportedly even higher, and recruitment and retention of qualified researchers was identified as a major problem.

~~Suggested causes are low salary levels, poorly designed or poorly administered evaluation systems, lack of incentives for superior performance, and lack of job satisfaction as a result of the imposition of infeasible expectations of performance, lack of logistical support, a lack of feeling of participation in program planning, and recruitment of individuals lacking the proper motivation.~~

Recommended Strategy - It is recommended that the Ministry of Agriculture:

- 1) raise salaries to competitive levels as soon as it becomes budgetarily feasible,

- 2) review and revise personnel evaluation, promotion, salary increment, and management policies within the constraints of civil service regulations to assure that personnel morale and motivation is maximized,
- 3) revise recruitment procedures to assure that adequately motivated and skilled individuals are recruited, and
- 4) establish a program to permit highly productive and motivated employees to attain higher degrees. Because upward mobility within the bureaucratic hierarchies of the REE system is conditioned upon having attained the appropriate level of education, a program which provides paid study leaves to highly productive employees will increase motivation and productivity of personnel.

Education

Ed-1

Recommendation - Improve and expand the Jamaica School of Agriculture.

Problem - A critical shortage of trained agricultural manpower exists in Jamaica. If the Government of Jamaica is to successfully carry out its agricultural development programs as announced in various planning documents, it will first need to give high priority to strengthening its capacity to educate the manpower needed to implement these programs. The Jamaica School of Agriculture (JSA) is the primary source of this manpower. It lacks the capacity to prepare agriculturalists in sufficient quantity and quality to meet Jamaican requirements.

The professional qualifications of the JSA faculty are not commensurate with their instructional responsibilities. Of the 35 active full-time academic faculty members, only seven have master's degrees. Three of the seven department heads do not hold baccalaureate degrees in the same fields as their areas of responsibility. Some faculty members have had little or no practical field experience in the areas for which they are preparing students.

It appears most unlikely that JSA can prepare the quantity of agricultural teachers envisioned in the Five-Year Education Plan (280 by 1982-83), or provide the projected numbers of agriculturalists implicit in the Five-Year Plan for agriculture, or even supply all the replacements for those who currently leave the REE system each year. Annual turnover rates for teachers approximate 50 percent; extension personnel, 20 percent. It appears that a JSA's annual output of graduates (127 in 1978) is insufficient to maintain the current number of professional personnel in the agricultural sector.

In recent years during a period of rapid inflation and increasing student numbers, JSA's budget has only increased moderately. This, combined with chronic need for improved personnel and fiscal management during the past decade, has had a devastating effect on the School's operational capacity. Consequently, campus structures are in dire need of repair, equipment cannot be used for lack of spare parts and maintenance, and "hands on" learning experiences have been curtailed. The school also needs additional land for instructional purposes.

Recommended Strategy

1. Upgrade the JSA faculty over the next six years so that all instructional personnel will have acquired at least baccalaureate

degrees and at least 50 percent will have acquired graduate degrees in their assigned fields of professional responsibility. Within 10 years, 80 percent of the JSA faculty ought to hold graduate degrees. Study leaves will need to be granted. Also, foreign and domestic specialists will be needed on an interim basis to fill the ensuing temporary vacancies.

2. Further strengthen the new three-year diploma program at JSA by:
 - a) Providing better classroom, farm, office, and transportation equipment, improved library collections, and adequate instructional materials.
 - b) Requiring all students to complete at least six (6) months of supervised agricultural (home economics) work experience during their thirty-six (36) months at JSA; and
 - c) Placing more emphasis on practical experience and background in admission of both agricultural and home economics students with special consideration given to graduates of the regional vocational and technical high schools as proposed in the recently prepared Ministry of Education planning document entitled "Agricultural Education as a Component of the National Agricultural Programme" (henceforth referred to as the Dunbar Report).^{1/}

^{1/} This report, released approximately one week prior to the team's departure from Jamaica, reviews the current status and makes proposals for development of agricultural education in Jamaica. With only minor exception, it is consistent with the philosophy, assumptions, and recommendations of this report.

3. Within two years, assess the necessity and feasibility of expanding the three-year diploma program at JSA into a four-year program leading to a Bachelor of Science degree in Agriculture by 1990. Consideration should be given to eventually re-establishing a two-tier system at JSA with programs leading to both the Associate of Science and Bachelor of Science degrees in Agriculture. This arrangement might better serve the diverse needs of Jamaican agriculture and optimize the use of faculty and facilities at an upgraded JSA.
4. Improve the quality of instructional programs at the secondary education level through better teacher and extension programs at the tertiary level, specifically at JSA. This is especially important because the all-age and new secondary schools must be relied on to prepare most of Jamaica's farmers over the next ten to fifteen years. In addition to immediately upgrading the teacher education faculty at JSA, it is recommended that a long term (5 to 10 years) cooperative assistance agreement be negotiated between JSA and an overseas university with a strong agricultural education program. Technical assistance in the form of faculty exchanges and other professional interaction should serve the interests of both institutions involved.
5. Permit graduates (Grade 12) of the regional vocational agricultural high schools consideration for advanced standing (one year) on application for admission to JSA. This will require closer articulation between secondary and tertiary education.

6. Select and acquire expanded facilities. The present JSA campus is inadequate, and it lacks room for growth, sufficient land for farms, and is not representative of conditions of small farmers in Jamaica i.e., hillside farming.
7. In order to make more efficient use of the physical facilities, staff, and faculty of JSA, a year-round academic program should be established. This will permit an expansion of the number of students and/or the intensification of the practical components of the curriculum.
8. The Ministry of Education and the Ministry of Agriculture should assess JSA's needs for additional funding and take appropriate steps to assure that JSA receives budgetary support in an amount and manner consistent with its role as the nation's foremost post-secondary institution of agricultural education. To make the best possible use of this support, JSA should continue to reduce its maintenance and operations staff and improve the management structure of the school. The position of vice-principal for administration and management should be established and filled with a highly competent administrator having experience in fiscal, personnel, and physical plant management.

Ed-2

Recommendation - Strengthen agricultural programs in all-age schools.

Problem - One often cited goal for the educational system is to educate the coming generation of farmers in intensive, small scale farm

production, beginning in the seventh grade and continuing through secondary and even post-secondary education. However, only a very small percentage of secondary school graduates and even a smaller percentage of post-secondary graduates have the desire or intention to farm for a living. In reality all-age schools formally educate the greatest number of small farmers.

In 1976-77, Ministry of Education data indicated that 231 of 570 all-age schools had gardens or tutorial farms ranging in size from one square chain to 20 acres. Approximately 100 all-age school agriculture teachers are thought to be agricultural graduates of secondary level institutions or of JSA. Per pupil expenditures for all-age school students are the lowest of all secondary school levels. If farmers are to be adequately prepared, an expanded program in all-age schools is required.

Recommended Strategy - It is recommended that increased funding and instructional support for agricultural education be given to all-age schools located in rural areas and that all-age schools be required to hire teachers trained in agriculture. Should the Ministry of Education implement the contemplated plan to establish secondary programs in the all-age schools, a major component should be vocational agricultural education.

Ed-3

Recommendation - Introduce a vocational agriculture student organization.

Problem - There appears to be a lack of community involvement, professional commitment, and esprit de corps among both teachers of

agriculture and their students. Although some agricultural students are enrolled in 4-H clubs, there is no intra-curricular or co-curricular student organization for students preparing to become farmers or agriculturalists.

Recommended Strategy - The Ministry of Education, Agricultural Education Section, should explore the possibility of developing a student organization as an integral part of instructional programs in agriculture. This organization could become a motivational device, communications tool, and leadership development mechanism for students enrolled in vocational agriculture. Colombia, Japan, and the Philippines are countries which have successfully introduced student organizations as a part of their instructional curriculum in agriculture. The Future Farmers of America (FFA) has operated successfully in the U.S. for over 50 years. Several countries have introduced the FAA concept into their educational systems after first modifying it to meet their educational needs in agriculture and home economics.

Ed-4

Recommendation - Introduce an agriculture community outreach program in secondary schools.

Problem - The school can be a major tool for promoting and improving agriculture in the local community; however, most teachers of agriculture appear to have very little contact with farmers and other persons in agribusiness in their communities.

Continuing education in secondary agricultural programs are valuable because they:

1. provide a mechanism for practical feedback to teachers and administrators from the agricultural community, thus helping to achieve a more in-school meaningful program.
2. provide a sense of community involvement which can improve the attitude, self-esteem, and sense of accomplishment for the teachers; and
3. provide for farmers a source of long term and more in-depth training than the usual extension field days or short courses, thus providing a more informed clientele for extension to work with.

Recommended Strategy - Each primary and secondary level agricultural program should be encouraged to develop an adult or continuing education dimension to promote better agricultural and homemaking practices in the local community, to develop rural leadership, to improve school/community relations and understanding of rural living, and to maximize the use of school facilities on a year-round basis. The Continuing Education program at the Elim Vocational Agricultural School appears to be a valuable new dimension to agricultural education in Jamaica.

Care should be taken however to avoid overlap and potential conflict with extension activities. There is the potential for mutually supportive roles. To avoid potential problems, extension personnel should be closely involved in the development of continuing education programs in vocational schools. Their advice on needed courses, their help in developing course content, and their help in recruiting students should be sought.

Ed-5

Recommendation - Increase articulation between pre-service and in-service education.

Problem - There is a lack of articulation between pre-service and in-service teacher education programs in agriculture. Without systematic feedback from its teachers and extension workers in the field, the Agricultural Education faculty at the Jamaica School of Agriculture will have difficulty in strengthening its pre-service programs. Furthermore, there appears to be no systematic plan for surveying the in-service needs of teachers and for coordinating the delivery of those services.

Recommended Strategy - The Agricultural Education faculty at JSA needs to become more closely involved with meeting the in-service educational needs of agricultural teachers, many of whom are graduates of the JSA. A number of organizations, ministries, and agencies provide some technical workshops for teachers and extension workers. However, the requests for, scheduling of, and delivery of these services should be arranged through the Agricultural Education Officer in the Ministry of Education.

Ed-6

Recommendation - Strengthen the self-help philosophy at JSA.

Problem - JSA has a serious problem in campus and farm maintenance. Due to this and other indications of poor management, correctional steps are being taken. The financial condition of the school has declined. For financial reasons it may be necessary to reduce student services and to require student assistance in the development of the school. Regardless of the necessity for this, requiring such service from the students

could have a positive effect in helping to develop the work ethic in the students and in increasing the students' sense of participation in and contribution to the school. If such a program is to be successful, however, the students will have to be treated more as partners in the development of the school rather than as simply unpaid laborers.

Recommended Strategy - First, it is suggested that each student be held responsible for cleaning his own room and doing his own laundry. Second, the students in each housing unit should be collectively responsible for cleaning and maintaining common areas and adjacent garden areas. In addition, each student should be assigned perhaps 10 hours per week to duties such as farm operation, grounds improvement and maintenance, cafeteria work, assisting skilled maintenance employees, and assisting in classroom, laboratory, or library programs. There is generally merit in students receiving pay for such work even though it is mandatory. However, the JSA students are already highly subsidized by the government, and it would not be unreasonable to require work without pay.

Research

Re-1

Recommendation - Prepare a long range plan for the development of a comprehensive research program and for the improvement of staff and facilities.

Problem - Inadequate attention has been devoted to developing a long range plan for implementing a coordinated agricultural research and development program in terms of required physical plant, equipment, laboratory facilities, staffing, and staff training. Although actions

to be taken in conjunction with implementing the IDB agricultural research project represent a major step in the right direction, this project will provide facilities for only two (Bodles and Montpelier) of the proposed three regional stations. Furthermore, the proposed staff training and upgrading under the IDB loan project are very limited in scope (ten scholarships of five months' duration, and five of two years' duration) and will not adequately address training needs for the development of a strong research program.

Recommended Strategy

1. The Ministry of Agriculture should prepare a detailed long-range plan for the development of a comprehensive research program which is based upon: a determination of key research problem areas (commodities, resources, socio-economic problems) set forth in order of priority need for the country; a rigorous internal assessment of the current ability to address these problems (in terms of quantity and quality of staff and facilities); an assessment of the extent to which applicable research recommendations can be borrowed from other countries; and a realistic estimate of the magnitude of a domestic research program that is required and sustainable within Jamaican resources.
2. Foreign assistance for improving manpower and facilities should then be "shopped for" on the basis of the overall research development plan, rather than building an externally assisted research program from bits and pieces of aid as it is proffered.

3. Particular attention should be directed towards providing for all existing professional research staff to be upgraded at least to the M.S. level within six years and determining the need for Ph.D. researchers, by discipline, within the next ten years.

Targets should be clearly spelled out in the Ministry's overall long range plan, including specified areas of training and phasing based on the assessment of current gaps in specific disciplines and projected research needs. The system should provide for continuous upgrading of new researchers being brought into the system and should formalize provision for government-sponsored training following a specific period of satisfactory research performance on the job (perhaps one to two years). To the extent feasible, the graduate training resources of U.W.I., both the Mona campus and Trinidad, should be utilized for M.S. level training, and all advanced degree work should require original thesis research. The possibility of those Jamaican students enrolled in the College of Agriculture in Trinidad being encouraged to conduct their thesis research in Jamaica on Jamaican problems should be explored, and appropriate cooperative arrangements developed.

Re-2

Recommendation - Establish an overall research program which is based upon priority research areas.

Problem - Within the MOA, there is an inadequate research focus, and thus misallocation of scarce resources. There is no clearly articulated research program which identifies a carefully selected set of specific priority areas for research. Overall research efforts appear

to be fragmented and somewhat haphazard -- a mix of quasi-commercial production activities, maintenance of plant "museums," casual observation plantings, and true problem-oriented agricultural research. Currently, the Plant Protection Department appears to have a relatively stronger research program than that of the Crop and Soils Department. Practically no real research is being carried out in soils. The Livestock Department research program is heavily oriented towards cattle, to the exclusion of small stock. No research is being conducted in socio-economic analysis, agricultural policy, or the general resources area.

Recommended Strategy

1. At the ministerial level (based upon inputs from scientific research personnel), establish an overall research program in terms of priorities;
2. Strengthen the review process for all new project proposals, and ensure that they fall within the established research priorities before they are approved;
3. Review all existing projects, and eliminate those that do not meet the agreed upon criteria;
4. Determine which activities are true research and which are actually commercial production, and transfer the latter responsibility to other organizations;
5. Determine what "museums" are actually required for the maintenance of a germ plasm bank (or other legitimate needs) and get rid of the remainder, thus freeing up the land and labor required for their maintenance.

Re-3

Recommendation - Establish a research coordinating committee.

Problem - There is inadequate coordination of research activities that are being conducted by the various departments of the Ministry of Agriculture, the statutory boards, and other organizations.

Recommended Strategy - The establishment of a top level research coordinating committee (a National Research Committee), to be chaired by the Permanent Secretary or his designee, which would be composed of the Ministry of Agriculture's Director of Research and the Director of Extension, the Directors of Research of each of the statutory boards, the Dean of the Faculty of Natural Sciences (U.W.I.), the Research Directors of other organizations active in agricultural research in Jamaica, the Principal of JSA, and farmer representatives. This committee should have regularly scheduled meetings (perhaps semi-annually or quarterly) at which time an exchange of information regarding the status of current research activities, new developments, problems, needs, etc., would take place.

The Committee could thus function as a central point for monitoring the overall agricultural research program, helping to provide broad directional guidelines and feeding into the system suggestions for needed new research activities. If delegated some fiscal (budgetary) authority, it could strongly influence the direction of national agricultural research.

Re-4

Recommendation - Improve recruitment and personnel management procedures.

Problem - Recruitment and retention of qualified research staff members who have a long-term interest in agricultural research and the innate abilities and requisite training to make a major contribution have been difficult. Salary levels in the Ministry of Agriculture are low relative to those offered for similar training and skills in other Jamaican quasi-governmental institutions, including the statutory boards, the Scientific Research Council, and others. As a result, difficulties have been encountered in attracting and maintaining qualified staff. The situation is even less favorable when comparing Ministry of Agriculture salaries with private sector salaries.

Recommended Strategy - Develop a closer relationship with the Jamaica School of Agriculture, and with the cooperation of the administration, identify bright and able students early in their programs. Develop a program whereby competent and promising students could be encouraged to continue their academic training through the B.S. degree at the University of the West Indies in areas of priority need by the Ministry of Agriculture. Guarantee these individuals employment at the satisfactory termination of their degree training, and provide them with paid on-the-job summer research internships at research stations during the summer months while they are out of school. Encourage the preparation of papers, theses, etc., based upon research problems of importance to Jamaica and with the guidance and supervision of specialists in their areas of interest at the research stations.

The magnitude of the existing salary gap should be carefully documented. The case should then be made that if government development policy does in fact assign priority to the agricultural sector, then the government must take those steps necessary to halt and reverse the

deterioration in relative salary levels and the loss of human capital.

Re-5

Recommendation - Improve personnel evaluation procedures.

Problem - Although personnel evaluations and the reward structure have moved nearer to an objective, performance-based system in recent times, there remains a lack of consistency within the Ministry of Agriculture in the use of the evaluation instrument. Even though an individual head of department may be generally consistent in evaluating personnel within his particular department, there exists the potential for significant inequities in relative ratings received by personnel in different departments. Furthermore, there is a serious lack of confidence in the integrity of the system in that researchers do not generally feel that superior performance is rewarded or unsatisfactory performance punished.

Recommended Strategy - The Ministry of Agriculture should first determine what its expectations are for its research personnel. It should then assure that the evaluation instrument and standardized set of procedures to be used provides an adequate assessment of desired performance, and adequately distinguishes among levels of performance. Finally, and very importantly, the administration must then ensure that the reward system faithfully reflects the evaluations and that there is sufficient differentiation in rewards for different performance.

Re-6

Recommendation - Establish closer working relationships between extension and research.

Problem - There is inadequate linkage between research and extension efforts and, thus, limited adoption of new practices. Although it is generally felt that a significant amount of good research has been conducted and that there is available in Jamaica a body of technical recommendations which (if put into practice on a wide scale) would significantly increase agricultural production, there is little evidence of the required wide-scale adoption of improved practices. This is particularly evident among the small and medium sized producers of crops and livestock for the domestic (non-export) market.

Recommended Strategy - Through both organizational modification and use of the reward system, encourage a closer working relationship between research and extension workers. Instill in each group the firm conviction that in the final analysis, the only really acceptable measure of their professional performance is to be found in increased output, increased incomes, and improved levels of living of the farm family. A first step would be the implementation of current plans to station an extension development officer on each of the experiment stations, but this should be regarded as merely the first preliminary step. The expansion of on-farm trials under farm conditions, conducted jointly by researchers and area extension workers, is another excellent means of: 1) identifying practical constraints to the adoption of practices developed and tested on the research stations, 2) establishing a closer working relationship between research and extension, 3) establishing a more effective extension worker/farmer relationship.

Experimental work on trials of varieties, plant population (density), fertilizers, pesticides, time of planting, weed control, etc., can be effectively conducted on farmers' fields following initial research on

the experiment stations. This permits testing under a wide range of soil, rainfall, temperature, topographic, and pest conditions. Given the site specificity of much crop research, this geographic spread is highly desirable. With proper cooperative relationships, both the farmers' land and labor may be made available free of cost to the research/extension program. Furthermore, the trial may encourage more widespread farmer recognition of research/extension efforts in the area and thus greater participation in programs.

The initiation of special in-service short courses for both old and new extension workers on crop and livestock production, conducted at the experiment stations and at the farms of participating farmers would bring extension workers more closely together, upgrade their technical competencies, and bring to bear the practical orientation of extension workers on the research programs. The training courses should be designed jointly by extension and research specialists and should provide adequate opportunity for technical interchange on a "seminar" basis.

As the concept of research commodity committees recommended by the FAO/IDB study is implemented, the significant participation of both extension workers and farmers should be enhanced.

Re-7

Recommendation - Devise procedures to improve the availability of imported research supplies, equipment, and spare parts.

Problem - As a direct result of Jamaica's deteriorating economic situation and the resultant foreign exchange crisis, there is a serious shortage of agricultural research supplies, equipment, and spare parts.

This scarcity is, of course, magnified at the farm level and thus constitutes a significant constraint to the adoption of modern agricultural production practices.

Recommended Strategy - The case must be made jointly by the Ministry of Agriculture, its colleagues in the statutory boards, and farmer groups that foreign exchange in adequate amounts must be made available on a priority basis for the agricultural sector. It is a very short-sighted policy to impose (either directly or indirectly) restrictions on the import of agricultural inputs which are required to implement the government policy of increased production of domestic food supplies and expanded export of major foreign exchange earning crops. Foreign exchange expended on agricultural chemicals, equipment, spare parts, etc., used in the research program will return the expended foreign exchange manyfold in future import substitution possibilities (food is a major import) and increased exports. In the short run, additional sources of external research funding support should be identified and explored as a means of alleviating the present situation.

Re-8

Recommendation - Base research personnel at research stations.

Problem - Too few Ministry of Agriculture research personnel are actually living on or near the research stations. Instead, the tendency is to live in Kingston and to make periodic trips to a station to lay out plots and supervise field laborers in planting, harvest, etc. As a result, the close day-to-day supervision, data collection, involvement in problem identification, and interchange with farmers and extension workers in the area is significantly constrained.

Recommended Strategy - Begin the phased implementation of the recommendation of the FAO/IDB report which urges assignment to field stations of the majority of research workers. If this decentralization plan is to have any likelihood of effective implementation, however, the Government must recognize the need for appropriate housing for research personnel and their families on or near the research stations, an acceptable quality of educational facilities for their children, and other requisite social amenities. In the absence of such facilities, the personnel decentralization plan is likely to encounter strong resistance.

Re-9

Recommendation - Improve security for field experiments.

Problem - Inability to conduct meaningful research programs because of theft of produce from experimental plots, and theft of livestock being used in research projects (praedial larceny).

Recommended Strategy - Identify those crops most vulnerable to field theft and, to the extent that research design permits, centralize these experimental plots in a single area of the station which can be more easily fenced and/or patrolled. Allocate the necessary funds from the budget to provide fencing and/or security guards to patrol these areas. Production of edible crops and fruits for observation or commercial purposes should be physically separated from the research area and preferably removed from the experiment station.

Re-10

Recommendation - Initiate economic analysis as a research component.

Problem - There is inadequate analysis of the economic feasibility of adopting technological practices that are being developed by the research program. Although the development of biologically feasible packages of recommended output-increasing technology is a necessary condition for economic development of the agricultural sector, it is not a sufficient condition. These packages must be tested at the farm level, under farm conditions, and found to return a sufficiently high profit over traditional practices to compensate the farmer for his additional effort and the increased risk that almost always accompanies expanded cash expenditures for inputs and the change to new cultural practices.

Recommended Strategy - The Ministry of Agriculture should establish an economic analysis section which would have responsibility for working closely with biological researchers both in research station project design (to ensure that the results will be susceptible to economic analysis) and with the field trials to assess economic feasibility at the farm level. Initially, this staff should be primarily composed of production economists and farm management specialists. Although the reorganization plan for the Ministry of Agriculture provides for some analysis of the economic feasibility of biological research findings, the current plan is to station the one or two economists charged with this responsibility in the Kingston office. This is not likely to achieve the required results. The economists should be physically located on the experiment stations and working closely with the biological scientists if their work is to have any real impact. Economists serving as planners in a central unit cannot fulfill this role.

Extension

Ex-1

Recommendation - Strengthen the professional training of the extension professional staff through requiring all new appointees to hold at least a diploma in agriculture and establish a program for current staff to obtain advanced education. .

Problem - Because of the complexity and diversity of Jamaica's farming systems, the design and implementation of extension programs requires a sophisticated understanding of the biological, physical, social, and economic relationships underlying agriculture. Many Jamaican extension personnel lack this level of education. In MINAG's extension staff there are only two Ph.D., five M.S., and thirty-two B.S. degree holders. Obviously a critical mass of advanced degree holders is lacking. Moreover, because of a lack of qualified staff a substantial number of headmen who lack even a diploma have been appointed acting area extension officers.

Recommended Strategy

1. In conjunction with JSA, immediately establish an in-service training program for extension officers lacking a diploma or higher degree. This program, of 9 to 18 months duration, should consist of both existing courses and specially designed courses. Consideration may be given to the feasibility of designing the program so that these individuals may qualify for a diploma in agriculture. Over the next six years, all area officers should be required to have attained at least the equivalent of a diploma through this program and replacement

of staff as attrition occurs. A long-run objective should also be established of requiring the equivalent to a bachelor's degree for area and divisional staff.

2. A goal of requiring parish, regional, and subject matter specialist staff to attain an M.S. degree should also be established. In order to achieve this goal an advanced degree training program for these personnel should be initiated. Over the next six years, through attrition and providing opportunities for study abroad, it should be possible to bring 50 to 75 percent of these staffs to the M.S. level, and over a ten year period, all such professionals should have attained the M.S.
3. In order to strengthen the training of new extension personnel MINAG should play a more influential role in JSA. Research and Development and Production Extension staff should help design and supervise JSA practical training. Regional Directors should keep in touch with the vocational schools in their respective regions and recommend that outstanding agricultural students consider extension as a career. Parish managers might help in the student selection process, and a rural background should be a prerequisite for a student studying agriculture. An internship program should be implemented for all agricultural students entering extension.
4. MINAG should provide a more intensive induction training program, both as a matter of standard orientation and to bridge the known gaps in knowledge and skills relative to the area of assignment. During a recruit's first year, he should

receive continuous intensive training and close personal supervision.

5. MINAG's excellent in-service training program should be continued and expanded. However, where personnel of different ministries work on the same field program, shared staffing for workshops should be sought. Also, at times, personnel of the ministries concerned might be brought together for training.

Ex-2

Recommendation - Assure that the extension officer's role at the parish level and below is largely educational.

Problem - In times of emergency and shortage of trained personnel, it is appropriate to assign roles to agencies which are not fully consonant with its primary function. However, responsibility for servicing credit and subsidy programs conflicts and impedes extension's role as educator. Moreover, extension lacks the manpower to meet its primary obligation, and the amount of time devoted to credit and subsidy administration is growing. Approximately 25 percent of extension officials' time is currently devoted to administrative functions relating to credit and subsidy programs.

Recommended Strategy - It is recognized that the Ministry has expressed concern over this situation. We support the proposal to free extension of administration of credit schemes. As much as possible, the service function should be transferred to the commercial banks or Peoples Cooperative Banks. Consideration should be given to utilizing JSA or similar organizations for the distribution of subsidized inputs. In the future, assignment of responsibilities to extension which impede

its primary function of education should be avoided. Extension's educational function would be protected if subsidy programs were administered by the division or parish offices. However, it should be recognized that this may require augmenting the staffs of these offices. Given that many of the subsidy programs have been in operation since Jamaica was a colony, a thorough assessment of their contribution to agricultural development should be undertaken.

Ex-3

Recommendation - Improve transportation for extension staff especially at the area and division levels.

Problem - A 1978 survey reveals that 459 field staff, including 315 extension workers and headmen, were immobile. Without transport, extension programs cannot be implemented. Transportation problems relate to shortage of vehicles, suitability of vehicles and conditions or lack of roads.

Recommended Strategy - Improve the present two-fold policy of:

1. staff-owned vehicles -
 - a. increase funds available for interest-free loans;
 - b. consider the possibility of permitting duty-free purchase of cars or other means of transportation for traveling staff.
2. Ministry-provided vehicles -
 - a. increase the use of smaller, fuel efficient vehicles with good maintenance records, and where feasible, motor-cycles;

- b. provide vehicles at the divisional and area office levels;
- c. develop pooling and scheduling systems.

Ex-4

Recommendation - Improve extension's physical facilities and equipment.

Problem - Divisional and area officers frequently lack adequate office and storage space and equipment such as duplicating machines, typewriters, and slide and movie projectors. Parish officers also lack sufficient equipment and adequate storage facilities for planting materials.

The Ministry of Agriculture has four training centers, three of which are poorly designed and too small to satisfy needs. Additional and improved dormitories, additional classrooms, and larger kitchens should be provided. In addition, they lack sufficient vehicles and equipment such as typewriters, audio-visual equipment, sewing machines, stoves, and cooking utensils (for home economics classes and demonstration farm equipment.

Recommended Strategy - As soon as budgetary constraints permit, these facilities and equipment should be obtained.

Ex-5

Recommendation - Improve coordination in extension planning and activities.

Problem - There is evidence of substantial cooperation between MINAG Extension and the extension services of the various statutory boards, but there is also substantial overlap and duplication of

activities. This causes role conflict among the respective staffs and often leads to confusion on the part of farmers. Although there are competent leaders in Research and Development, the Extension Production Department, and the Personnel and Training Division, there is a lack of adequate planned coordination for most effective impact in the field.

Recommended Strategy - Establish an extension coordinating committee in each region to plan and coordinate extension activities in the field. The committee should be chaired by the regional extension director and should include representatives of each statutory board and other agencies conducting extension programs in the region and all parish extension directors. The committee should review all proposed plans and programs in the region.

ANNEX I

JAMAICAN AGRICULTURE: A BACKGROUND

Agriculture's Role in the Economy

In 1978, agriculture's relative share of GDP increased from 7.2 per cent in 1973 to 9.7 per cent (of J\$3,932 million). This was primarily as a result of stagnation in the bauxite, tourist, and construction industries. Within agriculture, production for the domestic market is the largest component, contributing 49 per cent of agriculture's GDP. Livestock production, 23 per cent, is second in importance, and export agriculture and fisheries and forestry contribute 16 per cent and 12 per cent respectively.

The agricultural sector is the second most important source of export earnings. (See Table I.1.1). In 1977, agricultural exports were valued at J\$140,247,000 equal to 20 per cent of Jamaica's total. This was only exceeded by the bauxite industry which alone provides 71 per cent of exports.

Over the past decade, Jamaican agricultural exports have entered a period of decline. The volume index of food exports stood at 95.8 in 1977 as compared to 116 in 1969 (1974 = 100).¹ Although in nominal terms, the value of exports has increased, in real terms it has declined (approximately 15 per cent).

While food exports have been decreasing, imports increased rapidly until 1974. The volume index of food imports (1974 = 100) increased from 35.8 in 1969 to 100 in 1974.² Through the government's strenuous efforts, food imports have declined, and the index stood at 67.8 in 1977. As can be seen in Table I.1.2, food imports consist of cereals and cereal products, meat and meat products, dairy products and eggs, and fish and fish products.

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1. Jamaica Department of Statistics, Statistical Yearbook of Jamaica 1978, p. 608.
 2. Jamaica Department of Statistics, Statistical Yearbook of Jamaica 1978, March 1979, p. 604.

Table I.1.1
AGRICULTURAL EXPORTS 1977

	Value	Percent of Total Exports
Sugar	\$ 67,993,000	9.8
Bananas	16,747,000	2.4
Cigars and Cheroots	6,341,000	0.9
Coffee	6,179,000	0.9
Pimento	4,978,000	0.7
Other	37,979,000	5.5
Total Agriculture ¹	140,217,000	20.2
Bauxite, Alumina, Gypsum	493,915,000	71.2
Other Non-Agricultural Exports	59,249,000	8.5
Total Exports	693,411,000	100.0

Source: Jamaica Department of Statistics, Statistical Yearbook of Jamaica 1978, March 1979, p. 587.

1. Includes food and beverages (rum) and tobacco.

Table I.1.2 Food Imports 1974 and 1977

Commodity	1974		1977	
	Value J\$000	Percent of all imports	Value J\$000	Percent of all imports
Cereals & Cereal Products	83,884	9.9	55,722	7.1
Meat & Meat Products	22,094	2.6	18,647	2.4
Dairy Products & Eggs	25,742	3.0	17,819	2.3
Fish & Fish Products	16,687	2.0	10,769	1.4
All Foods	175,214	20.6	123,460	15.8
Total Imports	850,781		781,639	

Source: Jamaica Department of Statistics, Statistical Yearbook of Jamaica 1978, March 1979, p.578

As a result of government's import control program, total imports have declined substantially, and food imports have declined proportionately more, amounting in 1977 to only 15.8 per cent of imports. The relative proportions of the various agricultural products have not changed dramatically. Cereals remain between 45 and 50 per cent of all food imports.

Number of Farms and the Distribution of Land

According to the most recent available census data, there were 193,359 farms in Jamaica in 1968-69 (See Table I.1.3).¹ The two smallest categories (0 - 4.9 acres) accounted for 78.5 per cent of the farms, and the three smallest included 97.9 per cent of the total. The largest farms, those of 100 acres or larger, occupied 53.2 per cent of the land although they represented only 0.5 per cent of the farms. In contrast, the smallest farms, those of less than 5 acres, comprised only 15.4 per cent of the land.

A 1978 sample survey of farms estimated the acreage in each farm size category. (See Table I.1.3.) It indicates the total acreage of farms with less than one acre to have declined.² However, this may only reflect a change in the definition of landless, for the 1978 survey excluded all those with less than one-half acre of land.

Overall, the data imply an increase in average farm size. The acreage of the three smallest categories declined appreciably, while the acreage in medium large farms shows a 50.3 per cent increase. Total area under cultivation declined 10.2 per cent.

No estimates of the number of farms have been published since the 1968-69 Census of Agriculture. In order to estimate the number of farms for 1978, it was assumed that the mean size of farms in each farm size class did not change, and the 1968-69 mean size for each farm size group was divided into 1978 acreage for that size. This provides an estimate of 83,807 farms in 1978. However, we have been unofficially informed that the unpublished 1978 Census of Agriculture, which incorporates the same definition as that used in 1968-69, found approximately 150,000 farms (70,000 more than was estimated assuming an unchanged average farm size). The difference is partially explained by the more inclusive definition utilized in the Census. However, in 1968-69 there were only 4,768 landless farmers and 52,976 with less than 1 acre. Even if half the landless had less than half an acre, only about 30,000 of the difference could be accounted for. The source of the difference must be elsewhere. Thus, the 1978 estimate of both farm size and numbers must be used cautiously. For the

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1. Jamaica Department of Statistics, Agricultural Census Unit, Census of Agriculture 1968-69, Final Report Vol. 1, Part A, Kingston, January 1973.
 2. Jamaica Ministry of Agriculture, Data Bank and Evaluation Division, Crop Production Survey, CPS 373, June, 1979

Table I.1.3 Number of Farms by Size Groups, Jamaica 1968/69 to 1979

Client Group	Number of Farms		Percent of Farms		Acreage		Percent of Acreage		Percent Change in Area
	1968/69	1978 ¹	1968/69	1978	1968/69	1978	1968/69	1978	1968-78
Landless (0-.9 ac.) ²	57,744	(7,035)	29.9	8.4	22,736	2,770	1.5	0.2	-87.8
Small (1 - 4.9 ac.)	93,961	(44,575)	48.6	53.4	206,480	97,954	13.9	7.3	-52.6
Medium (5-24.9 ac.)	37,607	(25,868)	19.4	31.0	340,757	234,389	22.9	17.5	-31.2
Medium-Large (25 - 99.9 ac.)	3,055	(4,952)	1.6	5.9	127,208	191,210	8.5	14.3	50.3
Large (100 or more)	992	(1,016)	0.5	1.2	792,007	811,636	53.2	60.7	2.5
All Farms	193,359	(83,446)	100.0	100.0	1,489,188	1,337,960	100.0	100.0	-10.2

Sources: Jamaica Department of Statistics, Agricultural Census Unit, Census of Agriculture 1968-69, Final Report, Vol. 1, Part A, Kingston, January 1973.

Jamaica Ministry of Agriculture, Data Bank and Evaluation Division, Crop Production Survey, C.P.S.: 378, June 1979.

1. Only total acreage of each size category has been published for 1978. The number of farms in 1978 was estimated by assuming that mean farm size of each farm size category remained the same between 1968/9 and 1978.
2. The decline of landless from 1968-69 to 1978 in large part reflects a change in definition. For 1968, "landless" includes individuals who owned one square to less than one acre, or who had 12 economic trees, or one head of cattle, or two pigs, goats, or sheep, or one dozen poultry, or six bee-hives. For 1978, only those operating one-half to less than one acre of land were included.

most part, except for production statistics, the present study relies on data from the 1968-69 Census of Agriculture.

Agricultural Production

Agricultural Products. Jamaica agricultural production falls into five major categories: (1) crops principally for export, (2) crops principally for domestic use, (3) livestock and livestock products, (4) fish and fish products, and (5) forest products. The distinction between crops for export and those for domestic consumption tends to be somewhat arbitrary. Large quantities of bananas, citrus, coffee, and coconuts are consumed locally, although the precise amounts are not known. In the case of coconut, very little copra or oil is currently being exported, because of the decimation of the estates by lethal yellowing disease. In this study, all those crops which are produced on estates or which are exported in significant quantities are defined as crops principally for export. Examples of specific commodities included in each category are listed in Table I.1.4.

Quantity of Production. Table I.1.5 presents the volume and indices of production of the principal agricultural commodities of Jamaica. The data on export crops are estimated by various marketing boards selling the products abroad. The coconut and banana production estimates include a significant component for domestic consumption which can be only roughly estimated. Domestic consumption of citrus and coffee are not included as no estimates are available. Production of export crops other than coffee has fallen precipitously in recent years. Numerous factors have contributed to this, including reorganization of sugar estates into cooperatives, loss of technical manpower through emigration, declining efficiency of sugar mills, diversion of bananas, citrus and coconuts into the domestic market, poor weather conditions, and unfavorable farm gate prices.

The primary crops produced mainly for domestic consumption are roots and tubers. In 1978, 339,814 tons were produced, a record high. Among these crops, yams are the single most important group, followed by cassava and sweet potatoes. In 1978, Jamaica produced 320 pounds of yams per capita.

Vegetables are second only to yams in importance. In 1978, 128,193 tons were produced, 120 pounds per capita. Relatively small quantities of fruit and plantain, and other domestic food crops were produced in 1978, respectively 43,747 tons (40 pounds per person) and 39,137 tons (37 pounds per person). Estimates prepared by the Extension Service indicate that since 1968-70 production of crops for

Table I.1.4 Classification of Agricultural Products

Crops Principally for Export:

Sugar Cane
Banana
Citrus
Coffee
Cocoa
Pimento (all spice)
Coconuts

Crops Principally for Domestic Use:

Legumes
Vegetables
Condiments
Fruits except Bananas, Coconuts, Citrus
Cereals
Yams
Plantains

Livestock:

Cattle
Poultry
Sheep
Goats
Dairy Products
Eggs
Pork

Fish and Fish Products:

Forest Products:

Table J.1.5 Volume of Principal Commodities and Index of Production, 1968-78

Commodity	Units	PRODUCTION											INDEX OF PRODUCTION (1968=100)										
		1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	68	69	70	71	72	73	74	75	76	77	78
Crops Principally for Export																							
Sugar Cane	000 tons	4399	4004	4214	4041	4058	3504	3785	3524	3571	3177		105	95	100	93	97	85	90	84	85	76	
Bananas	Stems(000)	17953	14961	15540	19179	18480	12207	8754	9350	10346	11502		111	97	96	119	114	76	54	58	64	71	
Coffea 1/	TONS	925	1234	1169	1400	1026	1474	1150	1780	1027	1459		83	111	105	126	92	133	104	159	93	132	
Citrus 2/	boxes(000)	4074	3522	3566	3943	3920	2025	2244	2481	2480			109	95	96	106	105	54	60	67	67		
Cocoa 2/ 3/	tons	1491	1794	1827	2333	2071	1593	1771	1573	1614			84	105	107	117	122	93	104	92	95		
Coconuts(Copra)	nuts		120301	120506	144625	117719	98541	102573	89478	85205	122314			94	94	113	92	77	80	70	67	95	
Crops Principally For Domestic Use:																							
Vegetables	Tons	37805	34359	40841	60240	67210	63330	68011	70431	86190	105579	128193	94	85	121	109	167	157	169	174	214	262	118
Tubers & Roots	Tons	115619	120456	157177	221300	236600	203286	236303	231476	214490	266192	339814	88	92	120	109	180	155	180	177	164	203	259
Fruits and Plantains	Tons	12931	15963	22585	36902	40530	30559	34871	29098	27105	44928	43747	75	91	132	215	236	225	203	170	158	262	151
Other Crops	Tons	11612	11461	12071	16070	16790	14003	22395	25206	25140	28149	39137	97	96	107	134	148	117	187	211	210	215	327
Livestock & Livestock Products:																							
Beef	lbs(000)	28562	30254	27404	25775	27117	29063	28128	31169	28049	27233	25754	99	105	95	90	94	101	98	108	98	95	90
Dairy Products	Qln(million)	38.4	43.1	NA	42.0	41.0	41	43	43	42	41		91	106	-	103	101	101	106	106	103	101	
Poultry	lbs(000)	21850	26289	31546	40200	34300	44700	50000	59000	59137	67726	67765	82	99	119	151	129	168	191	225	223	255	255
Eggs 2/	million		208	210	159	123	136	139	147	162	152		108	109	83	64	71	72	76	84	79		
Pork	lbs(000)	10766	13196	15071	11113	15020	21213	9621	11261	15104	17430	16746	81	101	116	85	115	103	74	87	117	134	129
Sheep	lbs(000)	86	44	52	60	41	40	38	25	52	50	64	142	73	86	99	68	66	63	41	86	82	105
Fish & Fish Products 2/	lbs (million)		31	32	38	40	38	36	36	36	37		92	95	113	119	111	107	107	107	110		

SOURCES: Jamaica National Planning Agency, Economic and Social Survey 1970, 1973, 1975, 1978
 Jamaica Department of Statistics, Statistical Yearbook of Jamaica 1977, 1978.
 Mr. Roy Russell, Data and Evaluation Unit, Ministry of Agriculture

Footnotes:

- 1/ Purchases for export only. Does not include coffee and citrus that is consumed domestically.
- 2/ Index base; 1969-71 = 100
- 3/ Until the 1960's, Jamaica exported large quantities of copra and coconut oil. However, disease killed a large proportion of the trees and currently little is exported. Replanting is in progress and exports are expected to increase.

domestic consumption has increased from 255% to 327% for the various crops. Production of vegetables and other crops (legumes, cereals, and condiments) have shown the most increase.

Production of the most important source of domestically produced animal protein in Jamaica (poultry - largely chicken) has tripled since 1968. Egg production, on the other hand, has declined to 79% of its 1969-71 average. Both trends reflect the change in structure of the industry, from small family flocks to vertically integrated contact boiler operations.

Beef production, second in importance, has shown no increase in the past decade. Dairy production has also remained stable, and pork and sheep production have fluctuated significantly with no clear trends.¹

Value of Production. Historically, sugarcane was Jamaica's economically most significant agricultural product.² However, because its production has declined while the production of tuber and root crops and poultry have increased, both of these products now exceed it in total value. (See Table I.1.6). Other commodities of great significance are vegetables, beef, bananas, dairy, pork, plantain and fruit.

Production by Farm Size. In Table I.1.7, the 1977 value of production of major commodities is distributed among farm sizes. These data provide insights into the relative importance of each commodity to the individual farm sizes, as well as the relative importance of each size class in the production of each commodity. Most important, the relative contribution of each size class to the value of agricultural production is made clear.

The estimates in Table I.1.7 were derived using 1977 value of production data and 1968-69 distribution of acreage and animal numbers. The 1977 total value of each crop was multiplied by the proportion that each size class held of the acreage of the crop in pure stand, or the proportion of animals that each farm size class owned in 1968-69. For example, in 1977 the total value of sugarcane planted in

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1. Goats provide a major source of meat in Jamaica. However, no accurate records of its production are available. It probably exceeds pork in importance.
 2. The data presented and discussed here are not fully comparable. All crops as well as beef and sheep are valued at their farm gate value, while the remaining livestock are valued at their rural retain price.

Table I.1.6 Estimated Value of Production, 1977
(Jamaican dollars)

Commodities	Value (J\$000)
Crops Principally for Export:	
Sugarcane	67,154
Bananas	31,444
Coffee	3,000
Citrus	5,088
Cocoa	1,110
Coconuts	8,536
Crops Principally for Domestic Use:¹	
Vegetables	51,749
Tubers & Roots	90,859
Fruits & Plantain	11,043
Other Crops	44,986
Livestock:	
Beef	29,630
Sheep	51
Dairy ²	17,220
Pork ²	15,112
Poultry ²	79,063

Sources: Jamaica Department of Statistics, Statistical Yearbook of Jamaica 1978, March 1979, p.463.

1977 Production Statistics and Farmgate Prices, Ministry of Agriculture.

Jamaica Department of Statistics, Consumer Price Indices 1978, May 1979, p. 59.

1. Calculated by multiplying estimated acreage by farm gate prices.
2. Calculated by multiplying estimated production by rural retail prices.

Table I.1.7 1977 Value of Production by Client Group Distributed in Proportion to
1968/69 Crop Acreage and Livestock Numbers
(Thousand of Jamaican Dollars)

Commodity	Landless 0-.9 ac.	Small 1-4.9 ac.	Medium 5-24.9 ac.	Medium-Large 25-99.9 ac.	Large 100 or more ac.	All Farms
Crops Principally for Export:						
Sugar	191	5,025	8,471	2,663	50,805	67,154
Bananas	929	9,809	10,687	2,406	7,613	31,444
Coffee	91	1,056	1,381	200	272	3,000
Cocoa	22	382	542	58	106	1,110
Citrus	51	489	1,030	490	3,027	5,088
Coconuts	51	544	1,644	957	5,340	8,536
Crops Principally for Domestic Consumption:						
Yams	5,240	30,701	23,196	2,311	383	61,832
Potato (Irish)	222	2,584	2,035	537	378	5,755
Other Crops	4,430	37,545	37,034	7,570	31,490	118,070
Livestock:						
Beef	919	3,436	5,139	1,904	18,233	29,630
Sheep	4	17	17	4	9	51
Dairy	931	2,481	3,952	1,739	8,117	17,220
Goat						
Pork	2,998	5,401	4,277	1,366	1,070	15,112
Poultry	21,992	25,122	19,422	8,892	3,635	79,063
TOTAL	38,071	124,592	118,827	31,097	130,478	443,065
Percent of Total	8.6	28.1	26.8	7.0	29.4	100

1. Other crops include cereals (rice and corn), vegetables, legumes, condiments, fruits other than listed above, plantain, sweet potato, casava, coco, dasheen and sorrel.

pure stand. Thus \$67,154,000 was multiplied by .075 to estimate the contribution of small farmers to sugarcane production.

This method assumes that the distribution of farms among farm-size classes did not change between 1968 and 1977 and that their use of land and size of livestock herds remained the same. It does not include production in mixed stand and food forest. This biases the distribution of output in favour of the larger farm sizes since they produce most of their crop acreage in mixed stand and food forest. Finally, this method assumes that yields and production per animal unit are equal across all farm sizes.

Given the herioc assumptions implicit in the estimates of gross value of output of each crop by farm size class, it is obvious that Tables I.1.7 and I.1.8 should be interpreted and used with discretion. Rather than estimates of actual revenue, they provide a basis for assessing the importance of each farm size class in the production of each commodity and the relative importance of the crops to each farm size class.

Table I.1.8 shows that large farms are the primary producers of sugar (75.7%), citrus (59.5%), coconut (62.6%), beef (61.5%) and dairy products (47.1%), while farms under 25 acres in size produce most of Jamaica's domestically consumed food crops, bananas, coffee, cocoa, pork and poultry. The small farms derive the greatest share of their revenues from domestically consumed food crops and poultry whereas the large farms are much more dependent on sugar and beef.

Small, medium and large farms supply the bulk of the value of Jamaica's agricultural production. On a per acre basis, the landless and small farmer produce the highest revenues and the large farmer the least.

Natural Resources

Land and Land Use. Jamaica is poorly endowed with agricultural land. It is a mountainous island with almost 50 per cent of the land situated at over 1,000 feet above sea level. Of its total area of 2.7 million acres, 1.68 million acres are suitable for some form of agriculture and of these, only 1.2 million acres (44.9 per cent) are suitable for crops.

Most of the island's interior is steeply sloped and subject to erosion. Only the coastal plains and a few interior valleys contain

Table I.1.0 Value of Production by Farm Size Class and by Commodity

Commodity	Percent of Value of Production Produced by Each Farm for Commodities Size Class by Commodity						Percent of Farm Size Classes' Value of Production Derived from Major Commodities					
	Landless 0 - .9ac.	Small 1 - 4.9ac.	Medium 5 - 24.9ac.	Medium Large 25 - 99.9	Large over 100	Total	Landless 0 - .9ac.	Small 1 - 4.9ac.	Medium 5 - 24.9ac.	Medium Large 25 - 99.9ac.	Large over 100	Total
Crops Principally for Exports:												
Sugar	0.3	7.5	22.6	4.0	75.7	100.0	0.5	4.0	7.1	8.6	30.9	15.2
Banana	3.0	31.2	34.0	7.7	24.2	100.0	2.4	7.9	9.0	7.7	5.8	7.1
Coffee	3.0	35.2	46.0	6.7	9.1	100.0	0.2	0.8	1.2	0.6	0.2	0.7
Cocoa	2.0	34.4	48.8	5.2	9.5	100.0	0.1	0.3	0.5	0.2	0.1	0.3
Citrus	1.0	9.6	20.2	9.6	59.5	100.0	0.1	0.4	0.9	1.6	2.7	1.1
Coconut	0.6	6.4	19.3	11.2	62.6	100.0	0.1	0.4	1.4	3.1	4.1	1.9
Crops Principally for Domestic Use:												
Yams	8.5	49.7	37.5	3.7	0.6	100.0	13.8	24.6	19.5	7.4	0.3	14.0
Potato (Irish)	3.9	44.9	35.4	9.3	6.6	100.0	0.6	2.1	1.7	1.7	0.3	1.3
Other Crops	3.8	31.8	31.4	6.4	26.7	100.0	1.0	30.1	31.2	24.3	24.1	26.6
Livestock:												
Beef	3.1	11.6	17.3	6.4	61.5	100.0	2.4	2.8	4.3	6.1	14.0	6.7
Sheep	7.8	33.3	33.3	7.8	17.6	100.0	0.0	0.0	0.0	0.0	0.0	0.0
Dairy	5.4	14.3	23.0	10.1	47.1	100.0	2.4	2.0	3.3	5.6	6.2	3.9
Pork	19.8	35.7	28.3	9.0	7.1	100.0	7.9	4.3	1.6	4.4	0.8	3.4
Poultry	27.8	31.8	24.6	11.2	4.6	100.0	57.8	20.2	16.3	28.6	2.8	17.8
TOTAL							100.0	100.0	100.0	100.0	100.0	100.0

Table I.1.9 Area of Land by Soil Class

Soil Class	Acreage	Percent of Total
I	78,500	2.9
II	280,500	10.3
III	598,800	22.0
IV	262,800	9.7
V	461,780	17.0
VI & VII	1,033,524	38.1
TOTAL	2,715,904	100.0

Source: Jamaica, Ministry of Finance and Planning, National Planning Unit, Five Year Development Plan 1978-82, (Second Draft); Part I, II, III, p. III 116.

broad, flat areas of high quality soils. Because much land is either swampy or dry and sandy, drainage or irrigation is required for intensive crop agriculture.

Of Jamaica's 2,715,904 acres, 670,169 acres (25 per cent) are in crops; ruinate¹ occupies another 159,414 (6 per cent); 61,599 acres are in pasture (2 per cent); 353,851 acres (13 per cent) are in other uses and 1,377,945 acres (51 per cent) are not used in agriculture. (See Table I.1.10). Over the past 10 years, there has been a shift away from mixed stands and ruinate and increases of pure stand, grassland, and fallow. Overall, the amount of land in cultivation has increased.

The 1968-69 Census of Agriculture provides the most recent available data on the use of land by farm size classes. Since then, there have been major changes in the structure of Jamaican agriculture, both as a result of economic forces and explicit government policy. Tables I.1.11 and I.1.12 present a summary of the 1968/69 data. There were 357,412 acres under cultivation in pure stand; 24.3 per cent in domestic crop production and 75.7 per cent in export crops. Because this only includes pure stands, it substantially understates the acreage of domestic food crops. In terms of total acreage, sugarcane is the single most important crop, representing 44 per cent of cropland. Other food crops constitute the second most important category. Only two others, bananas and coconuts, account for more than 10 per cent of the total acreage. Every farm size class except the landless has more acreage devoted to export crops than to domestic crops. However, the small and medium size farmers have a relatively much larger proportion of their total acreage planted in domestic crops. Yams are the single most important crop to the small farmer, while sugarcane is most important for the three larger categories. Bananas are important to all the classes, occupying 15 to 20 per cent of the land of the small farm categories. Large farms have planted relatively small acreage of bananas.

The left side of Table I.1.12 provides an indication of which crops are produced principally on small farms and which are produced on large. Not surprisingly, sugarcane, coconut, and citrus are primarily large farm and estate crops. Farms of 100 acres and larger make up over 75 per cent of sugarcane acreage, 61 per cent of the

1. Ruinate is land that was formally cropped but is now covered with weeds, shrubs and a few low trees.

Table I.1.10 Land Utilization, 1968 and 1979

Land Utilization	1968	1978
	acres	
Pure Stand	357,412	453,415
Mixed Stand	200,478	116,754
Glassland	321,457	391,626
Fallow	34,337	61,599
Ruinatate	221,613	159,414
Other	353,851	155,151
TOTAL	1,489,188	1,337,959

Source: Jamaica, Ministry of Agriculture, Data Bank and Evaluation Division, Crop Production Survey, CPS: 378, June 1979, p. 1.

Table I.1.11 Crop Acreage and Livestock Numbers by Farm Size Class, 1968-69

Commodity	Landless	Small	Medium	Medium-	Large	Total
	0-.9 ac.	1-4.9 ac.	5-24.9 ac.	Large 25-99.9 ac.	100 ac. or more	
----- acres -----						
Crops Principally for Export						
Sugar	448	11,776	19,852	6,240	119,070	157,386
Bananas	1,225	12,929	14,087	3,171	10,035	41,447
Coffee	212	2,466	3,223	468	634	7,003
Cocoa	144	2,554	3,620	390	711	7,419
Citrus	184	1,748	3,683	1,750	10,823	18,188
Coconut	236	2,502	7,569	4,405	24,579	39,291
Total Exports	2,449	33,975	52,034	16,424	165,852	270,734
Crops Principally for Domestic Consumption						
Yams	2,191	12,836	9,698	966	160	25,851
Potato (Irish)	74	862	679	179	126	1,920
Other Crops	2,210	18,732	18,477	3,777	15,711	58,907
Total Domestic Crops	4,475	32,430	28,854	4,920	15,997	86,678
ALL CROPS	6,924	66,405	80,888	21,344	181,849	357,412
----- Livestock numbers -----						
Livestock						
All Cattle	8,640	32,316	48,339	17,910	171,505	278,710
Dairy Cattle	1,887	5,028	8,010	3,524	16,449	34,898
Goat	42,537	89,604	63,528	8,423	4,014	208,106
Swine	48,931	84,330	54,814	9,512	9,306	206,893
Poultry	1,113,916	1,272,425	983,721	450,406	184,116	4,004,584
Sheep	436	2,146	2,106	477	1,049	6,214

Source: Jamaica Department of Statistics, Agricultural Census Unit, Census of Agriculture 1968-69, Final Report Vol. 1, Part A, January, 1973

Table I.1.12 Percentage of Crop Acreage and Livestock Numbers by Farm Size and Percentage of Farm Acreage in Major Crops

	Farm Size Class Proportion of Acreage and Livestock Numbers						Crop Acreage as Proportion of Total Farm Size Class Acreage					
	Land-less 0-9 ac.	Small 1-4.9 ac.	Medium 5-24.9 ac.	Medium-Large 25-99.9 ac.	Large 100 ac. or more	Total	Land-less 0-9 ac.	Small 1-4.9 ac.	Medium 5-24.9 ac.	Medium-Large 25-99.9 ac.	Large 100 ac. or more	Total
Crops Principally for Export												
Sugar Cane	0.3	7.5	12.6	4.0	15.7	100.0	6.5	17.7	24.5	29.2	65.5	44.0
Banana	3.0	31.2	34.0	7.7	24.2	100.0	17.7	19.5	17.4	14.9	5.5	11.6
Coffee	3.0	35.2	46.0	6.7	9.1	100.0	3.1	3.7	4.0	2.2	3.5	1.9
Cocoa	1.9	34.4	48.8	5.3	9.6	100.0	2.1	3.8	4.5	1.8	3.9	2.1
Citrus	1.0	9.6	20.2	9.6	59.5	100.0	2.7	2.6	4.6	8.2	6.0	5.1
Coconut	0.6	6.4	19.3	11.2	62.6	100.0	3.4	3.7	9.4	20.6	17.5	11.0
Total Export Crops	0.9	12.5	19.2	6.1	61.1	100.0	35.4	51.2	64.3	76.9	91.2	75.7
Crops Principally for Domestic Use												
Yam	8.5	49.7	37.5	1.7	0.6	100.0	31.6	19.3	12.0	4.5	0.1	7.2
Potato (Irish)	3.9	44.9	35.4	9.3	6.6	100.0	1.1	1.3	0.8	0.8	0.1	0.5
Other Crops	3.8	31.8	31.4	6.4	26.7	100.0	31.9	20.2	22.8	17.7	8.6	16.5
Total Domestic Crops	5.1	37.4	34.6	5.7	18.5	100.0	64.6	40.8	35.7	32.1	8.8	24.3
Total Crops	1.9	18.6	22.6	6.0	50.9	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Livestock												
All Cattle	3.1	11.6	17.3	6.4	61.5	100.0						
Dairy	5.4	14.4	23.0	10.1	47.1	100.0						
Goat	20.4	43.0	30.5	4.0	1.9	100.0						
Pig	23.7	40.8	26.5	4.6	4.5	100.0						
Poultry	27.8	31.8	24.6	11.5	4.6	100.0						
Sheep	7.1	34.5	33.9	7.7	16.9	100.0						

1-1-11

coconut acreage, and 59.5 per cent of the land planted to citrus. On the other end of the scale are domestic food crops, coffee and cocoa. The smallest three categories (under 25 acres) account for 84 per cent of the land planted to coffee, 85.1 per cent of the cocoa acreage, and 77.1 per cent of the domestic food crops acreage. Bananas are fairly evenly distributed among all farm sizes.

Cattle are raised primarily on large farms (61.5% of the total) whereas goats, swine, and poultry are produced mainly on small farms.

Table 1.1.13 presents additional data on land use. The 1978 acreages of the various crops are summarized in column 1. In column 2 is shown the average acreage of each farm size group in 1968-69. It can be seen that the average size farm is 7.7 acres. Complete data on the mean acreage of all farms planting a given commodity are not available, as the numbers of farms growing each crop have not been published.

In the third column is the percent of land in cultivation. For the nation as a whole, 43 per cent of farm land was in cultivation. As might be expected, the smaller farmers tend to cultivate the highest proportion of their lands. However, because sugarcane is so important to large farmers, a relatively high proportion of their farms is in cultivation.

The fourth column presents average yields in 1978. These yields are low by international standards but have been increasing steadily.

Security of title is not a serious problem in Jamaica. As shown in the last column of Table 1.1.13 and in Table 1.1.14, most farms in Jamaica are owner-operated. Less than 10 per cent of farm land is operated by a renter or non-owner. It is, however, the small and medium-sized farmers who most frequently rent land.

Although quality distribution of land among farm sizes is not known, some generalizations are possible. With the exception of cattle ranches, large farms are found mostly in the coastal plains or interior valleys where land is of better quality. These farms are primarily export crop producers: bananas, coconuts and sugarcane. The hills are occupied by small farmers who produce domestic food crops, coffee, cocoa, and bananas. Of course, many small farmers operate farms in the plains, but they generally tend to occupy farms with poorer, hilly soils.

Table I.1.13 Land and Land Utilization by Farm Size Class and Commodities, 1978

Subject Matter	Total Acreage	Average Acreage	Percent in Cultivation	Yield Per Acre	Land Tenure
Farm Size Class	1978	1968/69	1968/69		
Landless (0-.9 ac.)	2,769.9	.4	68	-	1, 2
Small (1-4.9 ac.)	97,954.3	2.2	51	-	1, 2
Medium (5-24.9 ac.)	234,389	9.1	31	-	1, 2
Medium-Large (25-99.9 ac.)	191,210	41.6	27	-	1, 2
Large (100 ac. & more)	811,636.4	798.4	49	-	3, 4
Total	1,337,959.9	7.7	43	-	
Commodities					
Crops Principally for Export					
Sugarcane	114,100	NA	-	24.5 tons	3, 4
Banana	26,466	2.6 ac.	-	353 stems	1, 2
Citrus	18,188	NA	-	NA	1, 2
Cocoa	33,000	1.4 ac.	-	2.1 tons	1, 2
Coffee	22,000	.8 ac.	-	163 lbs.	1, 2
Crops Principally for Domestic Consumption					
	(1978)		(1978)		
Vegetables	27,105	NA	-	9,459 lbs.	1, 2
Legumes	35,014	NA	-	751 lbs.	1, 2
Roots & Tubers	65,506	NA	-	10,375 lbs.	1, 2
Condiments	6,287	NA	-	5,008 lbs.	1, 2
Fruits	8,762	NA	-	9,986 lbs.	1, 2
Cereals	13,553	NA	-	1,513 lbs.	1, 2
Pasture	391,696	NA	-	-	1, 2, 3
	(1979)				
Forest	264,885	-	-	NA	5
NA = Not Available					
		1 = Land held in free title		3 = Estates	
		2 = Rental		4 = Cooperatives	
		5 = Publicly owned lands			

Sources: Jamaica, Department of Statistics, Agricultural Census Unit, Census of Agriculture 1968-69, Final Report Vol. 1, Part A, January, 1973.

Jamaica Department of Statistics, Statistical Handbook of Jamaica 1978, 1979.

U.S. Department of Agriculture, "The Small Farmer in Jamaican Agriculture: An Assessment of Constraints and Opportunities", Kingston, Nov., 1978.

Table I.1.14 Acreage in Farms Classified by Tenure
and by Farm Size Class 1968-69

	Owned	Rented In	Rent Free	Other	Total
Landless (less than 1 acre)	13,680	4,751	4,276	323	23,030
Small (1.-4.9 ac.)	142,563	43,004	21,866	2,234	209,667
Medium (5-24.9 ac.)	283,431	41,894	20,013	2,534	347,872
Medium Large (25- 99.9 ac.)	112,434	12,755	6,582	1,328	133,159
Large (100 ac. or more)	793,695	34,138	6,112	122	834,067
Total	1,345,863	136,542	58,849	6,541	1,547,795

Source: Jamaica Department of Statistics, Agricultural Census Unit,
Census of Agriculture 1968-69, Final Report, Vol. IV, Part B,
p.24

Climate and Water

Although on the average, rainfall in Jamaica is quite favourable, there is substantial variation regionally and over time. The average for the period 1931-60 was 73 inches; however, between 1968 and 1977 there were two years when the nation averaged less than 60 inches and four years when it was less than 70 inches.¹ The variation within the country is also substantial. The Parish of St. Catherine is the driest, 56.9 inches per year, while Portland is wettest, 153.5 inches per year. Local droughts as well as floods are not unusual, and frequently these are nationwide in scope. Localized droughts are even more frequent.

Generally, the southern coast, which is in the rain shadow of the central mountains, is the driest part of the country. This region is dependent on irrigation for crop production or must utilize its lands for livestock production. Portions of the north coast are also somewhat drier than the national average. Generally, it is the mountain areas which have the most rainfall. Thus, the small and medium farms of the mountains producing domestic food crops, cocoa, and coffee have the greatest total rainfall, while the small and large farms of the coastal plains are in a less favourable position. It is in those areas that most of the nation's cattle are raised, and sugarcane, bananas, citrus, and coconuts are cultivated.

In order to provide alternative sources of water for agriculture, the government has a program for subsidizing small impoundments and water tanks and has developed several relatively large irrigation projects. Piped water is available in most of the urban areas of the country. However, in rural areas, particularly in the mountains, piped water is a rarity. Typically, the rural population is served by roadside standpipes. In many areas, water is carried from streams or caught on individual roof catchments.

Factors of Production in Agriculture

Labor. The Jamaican agricultural labor force in 1977 was 271,900, 28 per cent of the total labor force.² In contrast to other less developed countries, it is well educated; 90.5 per cent have some primary

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1. Meteorological Division, Ministry of Public Utilities and Transport as reported in: U.S. Department of Agriculture, "The Small Farmer in Jamaican Agriculture: An Assessment of Constraints and Opportunities," U.S.A.I.D., Kingston, Nov. 1978, p. 49.
 2. Jamaica Department of Statistics, The Labour Force 1977, May 1978, p. 14.

education, while only 5.5 per cent have no formal education.¹ Women comprise twenty-eight per cent of the agricultural labor force.

Incomes in agriculture are substantially lower than in Jamaica as a whole; 11.9 per cent of agricultural labor received no income during the labor survey week of October, 1977, as compared to only 7.7 of the total labor force reporting no income.² Similarly, 46.8 per cent of the agricultural workers earned less than \$20 per week, while 34.3 per cent of the total labor force had a similar income. In 1968/69 the average age of farmers was 48.6, and is widely thought to have increased to over 50 in the last decade.³ As in most countries, Jamaica's agricultural labor force can be described as less educated, poorer, and older than the average for the national labor force.

Because of relatively low agricultural incomes, migration to urban areas has been substantial. In the 1960's, urban population grew 3 per cent per annum while rural population fell an annual rate of 0.6 per cent.⁴ This trend, it appears, is continuing. Between 1970 and 1977 Kingston grew from 475,000 to 639,000. This translates into a growth rate of 4.3 per cent while national population grew at a much slower annual rate of 1.7 per cent per annum.⁵

Jamaica's agricultural sector is faced with an increasing urban demand for food while having a smaller labor force to produce that food.

Almost all Jamaicans utilize some hired labor during some portions of the year. Surveys conducted by the Ministry of Agriculture indicate that the quantity hired varies substantially during the year as requirements change and also varies with the size of the farm.⁶ Despite high unemployment rates and substantial hiring, farmers complain about

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1. Ibid., p.59
 2. Ibid., pp. 69-70.
 3. Jamaica Department of Statistics, Agricultural Census Unit, Census of Agriculture 1968-69, Final report, Vol. III, Part A, March 1974, p. iv.
 4. Jamaica, Department of Statistics, Pocketbook of Statistics, 1977.
 5. Jamaica Department of Statistics, Statistical Yearbook of Jamaica 1978, Kingston, pp. 125-8.
 6. Jamaica Ministry of Agriculture, Data Bank and Evaluation Division, Crop Production Survey, CPS 378 June 1979, p. 5.

the scarcity of labor. When asked to list their problems, unavailability of labor is the fourth most frequently mentioned problem, only exceeded by "insufficient capital," "lack of adequate water supply," and "inadequate road network."¹

Chemicals. Because of Jamaica's recent foreign exchange crisis, the importation and consumption of agricultural chemicals has declined in recent years. Fertilizer consumption fell by about one-third during the period 1971-1977. Although larger farmers are the primary users of agro-chemicals, smaller farmers frequently utilize them when they are available. The Ministry of Agriculture encourages use of fertilizer by providing a 33 per cent subsidy. Given the scarcity in recent years, it is not possible to assess fertilizer acceptance and use by Jamaican farmers. It is clear, however, that the demand for agro-chemicals exceeds their supply. Falling yields and production of export crops in recent years may in part, be explained by the declining availability of these production inputs.

Mechanical. Jamaica's small farmers own little mechanical equipment, and large farms appear to be less mechanized than comparable large farms in other countries. In 1969, large farms (100 acres or larger) owned 1,544 (1.6 per farm) of the nation's 1,745 tractors, and 3,134 of the 3,784 trailers.² Although the nation's estates are mechanized, it is explicit government policy to encourage use of labor in order to reduce unemployment. The result is more intensive labor use and higher unit costs than similar industries in other countries.

Small farmers were much more likely to own hand pumps. Farms under 5 acres in size owned 1,057 hand pumps of the total 4,614; and farms 5 acres to 24.9 acres had an additional 1,398. The Ministry of Agriculture offers subsidized plowing service; but because of the Ministry's limited resources, only a limited number of farmers have access to this service. It is also attempting to establish machinery pools for farmers operating less than 100 acres. Because of import restrictions, small farmers have had difficulties in obtaining hand tools in recent years.

Technology and Management. Even relatively unsophisticated observers note that the level of technology and management in Jamaica's crop production can be improved. Average yields are substantially

1. Ibid: Table 8.

2. Jamaica Department of Statistics, Agricultural Census Unit, Census of Agriculture 1968-69, Final Report Vol. IV, Part B, March 1974, p. 41.

lower than those achieved on the better farms. It is widely thought that production can be increased substantially through the use of improved practices -- improved farming systems, better spacing, more frequent weeding, regular fertilization, spraying, etc. On the other hand, few improved practices have been adequately tested under the actual conditions facing the small farmers producing the nation's food.

Similarly, the estate production of exports and livestock is said to be relatively inefficient. As noted earlier, production has been falling for many years, and yields, too, have declined substantially. This has many causes including declining private sector investment due to fear of nationalization, low farm prices, labor problems, restructuring of the estate industry into private farms, the declining efficiency of the sugar mills, unavailability of parts and equipment due to import restrictions, and declining quality of management.

Credit.¹ Jamaica has five major sources of credit, one private and four public: (1) commercial banks, (2) the Jamaica Development Bank (JDB), (3) the Agricultural Credit Board (ACB), (4) the Self-Supporting Farmer Development Program (SSFD), and (5) the Crop Lien Program. Commercial Banks offer short-term credit to large farms, to estates, and to large agricultural cooperatives. Average loan size exceeds J\$100,000. Only 4 per cent of commercial loans are in arrears.

The Agricultural Credit Board offers two lines of credit, short-term and seasonal credit, directly to larger farmers and indirectly to small farmers through the Peoples Cooperative Banks. Funds are domestic in origin. Thirty-nine per cent of total loans outstanding are in arrears.

The Self-Supporting Farmer Development Program, funded by the Inter-American Development Bank, provides supervised long-term credit to medium and medium-large farmers. Forty-five per cent of its portfolio value is in loans of under \$5,000, and 8.1 per cent (26.5 per cent of the number of loans) is in loans of less than \$2,000. Because the Self-Supporting Farmer Development Program includes intensive supervision, careful loan appraisal, and a relatively intensive collection program, its arrears are the lowest of any of the funded programs, 18 per cent of the total outstanding loans and 38 per cent of amounts due.

1. This discussion of credit is based on: Douglas H. Graham and Compton Bourne, Agricultural Credit and Rural Progress in Jamaica, Paper presented at Workshop on Rural Financial Markets and Institutions, Wye College, Wye, England, June 12-14, 1979.

The crop lien program was established in 1977 as part of the Emergency Food Plan to encourage increased domestic food production. Administered by the Ministry of Agriculture with the Peoples Cooperative Banks, it provides small farmers short-term loans. Its arrears rate (94.6 per cent) is so high as to raise the question whether it is properly termed a credit program or an income transfer program.

Table I.1.15 presents the total loans outstanding between 1970 and 1977. Although the total amount has nominally increased more than six-fold during the time span, in real terms growth has been much slower, but positive. In Table I.1.16 the distribution of loans among farm sizes is documented. The proportion of the total portfolio going to large farmers has increased substantially, while small farmers' loans have decreased in importance.

The large farmer has adequate access to credit at the present time. Both short-term and long-term funds are available. The small farmer and medium sized farmer have access to short-term and intermediate-term credit, and the total amount already distributed does not fulfill their needs. Even this minimum structure is in serious jeopardy. Because of the extremely high arrears rate in all the publicly funded programs, it appears that, without substantial external funding, the entire system may collapse.

Transportation and Markets. Jamaica has a very extensive, usually well developed road system for a country with its topography and stage of development. Hard surface roads connect all major towns, and rural towns are rarely more than two miles from the nearest hard surface road. Even most farms are within two miles of a road. However, because of the bulkiness of agricultural products and the hilly topography of much of the island, these two miles constitute a serious impediment to the farmer, particularly small farmers producing for the domestic market. The large and medium-large farmers producing for export markets have excellent access to roads. Maintenance of roads is a serious problem throughout the island, but particularly in the mountains.

The island has two distinct marketing systems. For the export crops, marketing boards provide basic processing and storage services and facilities. These facilities are typically modern and relatively efficient, although seriously underutilized. Domestic food crops marketing is dominated by higglers (traders).

A recent survey indicates that there are approximately 14,000 higglers in Jamaica ranging from retailers selling a few dollars of produce on the sidewalks of Kingston to large integrated middlemen who purchase directly from farmers and sell to consumers in the major

Table I.1.15 Percentage Distribution of Total
Agricultural Loans Outstanding
by Farm Size and Sources

Farm Sizes ¹ and Sources	Years			
	1971	1974	1976	1977
Large Farmers and Cooperatives				
Commercial Banks	39.1	44.2	60.2	54.4
ACB	4.7	4.2	14.4	14.7
JDC	2.0	12.4	14.2	14.7
Total	45.8	60.8	77.4	72.0
Medium Farmers				
SSFDP	13.2	16.2	11.5	12.7
Small Farmers				
ACB-PCB	40.9	22.9	11.0	9.5
Crop Lien				5.7
Total	40.9	22.9	11.0	15.2

Source: David H. Graham and Compton Bourne, "Agricultural Credit and Rural Progress in Jamaica: A Development Dilemma", Paper presented at Workshop on Rural Financial Markets and Institutions, Wye College, Wye, England, June 12-14, 1979, p. 12.

1. Definition of farm size classes are not consistent with those used elsewhere in this paper.

Table I.1.16 Agricultural Loans Outstanding, 1970-77

Year	Loans Outstanding
	J\$(000)
1970	25,320
1971	30,557
1972	35,162
1973	49,005
1974	60,060
1975 ¹	112,743
1976	136,721
1977	166,451

Source: David H. Graham and Compton Bourne, "Agricultural Credit and Rural Progress in Jamaica: A Development Dilemma, Paper presented at Workshop on Rural Financial Markets and Institutions, Wye College, Wye, England, June 12-14, 1979 p. 10.

1. The increase in 1975 in part reflects a change in definition of agricultural loans, with the result that certain loans previously categorized as non-agricultural were reclassified in 1975 as agricultural.

urban markets.¹ For the most part, higgler simply provide exchange and transportation service. Agricultural produce is not packed, graded, stored or processed. The primary forms of physical capital are market sheds or buildings, slaughter houses provided by municipal authorities, and vehicles owned by larger higgler. Market information is rudimentary, and technical services are virtually non-existent.

The one exception to the above generalizations is in the marketing of poultry and eggs. This industry is vertically integrated from production and input supply to wholesaling.

The canning and processing industry is well developed but suffers from serious over-capacity. Tables I.1.17 and I.1.18 present a summary appraisal of Jamaica's marketing system.

Summary

Landless, Small and Medium Farmers

Land.

1. Steeply sloped land of poor soils subject to erosion.
2. Land base of very small farmers inadequate to produce acceptable level of income.
3. Inadequate water supplies, particularly in southern coastal areas, but also during periods of droughts in other areas.

Labor.

4. Limited family labor and expensive hired labor in short supply seasonally.

Chemicals and Fertilizers.

5. Due to import restrictions, chemicals are difficult to obtain.

Practices and Management.

6. Improved technologies are rarely available and when available not fully tested in most cases.

1. Smikle, C. and H. Taylor. Higgler Survey Agricultural Planning Unit, Ministry of Agriculture, Kingston, May 1977.

Table I.1.10 Summary Appraisal of Market System for the Major Commodities

++ = very adequate
 + = adequate or near capacity utilization
 - = inadequate or low use of capacity
 -- = very inadequate

Commodities	Transportation			Storage						Processing									Market Exchange						
	Roads	Transport Services	Road & Truck Maintenance	Farm		Market Town		Kingston		Farm			Market Town			Kingston			Farm		Market Town		Kingston		
				Facilities	Technical Services	Facilities	Technical Services	Facilities	Technical Services	Facilities	Technical Services	Capacity Utilization	Facilities	Technical Services	Capacity Utilization	Facilities	Technical Services	Capacity Utilization	Market Facilities	Market Information	Market Facilities	Market Information	Market Facilities	Market Information	
Crops Principally for Export																									
Sugar Cane	+	++	-	NA	NA	+	+	+	-	NA	NA	NA	+	+	-	NA	NA	NA	NA	NA	+	-	NA	NA	
Bananas	+	+	--	NA	NA	-	--	+	-	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	-	--	-	--	
Citrus	+	+	-	-	--	--	--	+	-	NA	NA	NA	+	-	-	+	--	--	NA	NA	-	--	-	--	
Cocoa	-	-	--	NA	NA	+	+	+	-	NA	NA	NA	+	-	-	NA	NA	NA	NA	NA	-	--	+	--	
Coffee	-	-	--	NA	NA	+	+	+	-	NA	NA	NA	+	--	NA	NA	NA	NA	NA	NA	-	--	+	--	
Crops Principally for Domestic Use																									
Vegetables	-	-	--	--	--	--	--	--	--	NA	NA	NA	+	--	--	+	--	--	NA	NA	-	--	-	--	
Tubers & Roots	-	-	--	--	--	--	--	--	--	NA	NA	NA	+	--	--	+	--	--	NA	NA	-	--	-	--	
Fruits	-	-	--	--	--	--	--	--	--	NA	NA	NA	+	--	--	+	--	--	NA	NA	-	--	-	--	

Table I.1.18 (Cont.)

++ = very adequate
 + = adequate or near capacity utilization
 - = inadequate or low use of capacity
 -- = very inadequate

Commodities	Transportation			Storage						Processing						Market Exchange								
	Roads	Transport Services	Road & Truck Maintenance	Farm		Market Town		Kingston		Farm			Market Town			Kingston			Farm		Market Town		Kingston	
				Facilities	Technical Services	Facilities	Technical Services	Facilities	Technical Services	Facilities	Technical Services	Capacity Utilization	Facilities	Technical Services	Capacity Utilization	Facilities	Technical Services	Capacity Utilization	Market Facilities	Market Information	Market Facilities	Market Information	Market Facilities	Market Information
Livestock & Livestock Products																								
Beef	+	-	--	NA	NA	--	--	--	--	NA	NA	NA	--	--	-	--	--	-	NA	NA	--	--	--	--
Dairy Products	+	-	--	-	--	-	--	-	--	-	--	-	-	--	-	-	--	-	NA	NA	-	--	-	--
Pork	+	-	--	NA	NA	-	--	-	--	NA	NA	NA	-	--	-	-	--	-	NA	NA	-	--	-	--
Goats & Sheep	+	-	--	NA	NA	-	--	-	--	NA	NA	NA	-	--	-	-	--	-	NA	NA	--	--	--	--
Poultry	+	-	--	NA	NA	+	-	+	-	NA	NA	NA	+	+	-	+	+	-	NA	NA	+	--	+	--
Eggs	+	-	--	NA	NA	+	-	+	-	NA	NA	NA	+	+	-	+	+	-	NA	NA	+	--	+	--
Fish & Fish Products	+	-	--	NA	NA	-	--	-	--	NA	NA	NA	-	--	-	-	--	-	NA	NA	--	--	--	--
Forestry	-	-	--	NA	NA	-	--	-	--	NA	NA	NA	-	--	-	-	--	-	NA	NA	-	--	-	--

Appropriate Machinery and Equipment.

7. Little has been designed and made available to small farmers. That which is known is difficult to obtain due to import restrictions. Even machetes and files to keep them sharp have been difficult to obtain.

Capital and Credit.

8. There is a lack of capital and a poorly functioning and poorly managed credit system. No long-term capital from any institutional source is available.

Technical Services.

9. Minimal technical services are available from the Extension Service or other organizations.

Infrastructure.

10. There is limited access to electricity, poorly maintained roads, and a lack of piped water.

Markets and Marketing.

11. Little market information is available.
12. No price differentials are paid for higher quality products, and there is no grading or packing of food crops.
13. There is substantial waste and spoilage of produce (poor storage facilities).

Medium-Large and Large Farmers

Land.

1. In some areas land is dry, light, and sandy, while in others it is too wet to farm without drainage.

Water.

2. On the southern coast, many areas require irrigation for intensive cultivation. Even where normal supplies are adequate,

droughts occur fairly frequently. The irrigation system is poorly designed and managed.

Labor.

3. The relatively high cost labor frequently utilizes strikes, slow-downs, and "work-by-rule" to achieve economic and political goals.
4. There is a shortage of skilled manpower.

Practices and Management.

5. Trained, experienced management is difficult to obtain.

Machinery and Equipment.

6. New equipment and spare parts are difficult to obtain.

Credit Capital.

7. Private institutional sources of long-term credit are unavailable.

Technical Services.

8. Services are difficult to obtain and frequently low in quality.

Disease.

9. Lethal Yellowing Disease of Coconuts requires replanting of virtually the entire population of trees. Black pod and cocoa, coffee borer, and Panama Disease also created problems.

Infrastructure.

10. Poorly maintained roads.

Markets and Marketing.

11. Little market information is available.
12. Processing plants are inefficient.

Policy.

13. Mixed signals from government have inhibited investment in agriculture.

ANNEX II

JAMAICA'S DEVELOPMENT GOALS, OBJECTIVES AND STRATEGIES

In order to provide an understanding of the context within which Jamaica's REE institutions must perform in the future, this chapter presents a description of the official goals and strategies as enunciated by the Jamaican Government. It must be recognized that this requires the summarization of development plans which are several hundred pages in length -- a formidable task. Consequently, the following synopsis will undoubtedly suffer from a number of significant omissions.

In the interests of accuracy, official government language will be excerpted liberally and, in many instances, verbatim.

NATIONAL GOALS

The objectives specified in the current development plan are:¹

- (1) consolidation and development of the mixed economy in which the state owns or controls the basic industries of the economy, while ample scope is left for private-sector initiative and involvement, regulated through appropriate controls and incentives in the public and national interest;
- (2) economic policy aimed at providing an adequate supply and an effective and equitable distribution of necessities to the masses of the population. The most important of these are food, housing, clothing, employment, medical care, and education. An important additional policy objective is the reduction of the present structural dependency of the economic system through development of structural interdependence between and among the major producing sectors;
- (3) social policy aimed not only at providing an adequate supply of social services but also at the promotion of social justice in the widest and deepest sense; social and economic egalitarianism and the promotion of participatory forms of social, economic, and political organization;

1. Jamaica Ministry of Finance and Planning, National Planning Agency, Five Year Development Plan 1978-82 (Second Draft) Parts I and II, pp. I. 14 - I. 15.

- (4) spatial and physical planning conditioned by the need to integrate the economic and social aspects of development and to reconcile these with the objectives of promoting community development, rural development, and balanced development of the different regions of the country;
- (5) foreign relations policy conditioned by the need to diversify away from acute dependence on the developed capitalist countries; the consequent necessity to develop relations with the socialist countries, the need to continue and expand relations with the other third world countries;...

Instrumental to the achievement of these goals are the following strategies and subgoals:

- (1) Change the structure of the economy to redress the constraint that import availability places on the growth of real output.
- (2) Generate employment for the lowest-income groups of the population in the production of basic needs goods and services at minimum cost in terms of capital investment and foreign exchange.
- (3) Make much more efficient and productive use of government resources ... and mobilize marketing resources from the community for the provision of public goods and services.
- (4) ... development, conservation, and use of basic human and natural resources.

The agricultural sector goals and targets are well summarized in the development plan and are quoted directly below.¹

The plan for the agriculture sector is set within the framework of an integrated rural development strategy centered on agriculture, which is geared to making the rural environment so attractive as to reduce the migration of people to the towns and cities. This approach implies the development of basic infrastructure which will provide rural people with easy access to adequate housing, water, health and education facilities, as well as improved facilities for electricity, transportation and communication. Within this rural setting, opportunities will be created for expanding the productivity of agriculture

1. Ibid., pp. II.32 - II.38.

while taking full advantage of the inter-relationships between agriculture and other sectors of the economy, especially industry and tourism.

Based on the above philosophy for rural development, the broad objectives of the Five-Year Plan for agriculture may be stated as follows:

- (i) to maximize the production of food and agricultural raw materials to meet the requirements for:
 - (a) adequate food and nutritional levels of the population;
 - (b) agro-industrial development;
 - (c) export markets;
- (ii) to structure production so as to reduce reliance on imports;
- (iii) to ensure that all agricultural land is retained and used for agricultural purposes, efficiently and soundly;
- (iv) to improve rural amenities and social infrastructure as a basis for raising the standard of living of rural people;
- (v) to increase rural incomes (particularly farm incomes);
- (vi) to provide more employment opportunities so as to reduce unemployment and underemployment;
- (vii) to ensure that the necessary inputs for agricultural production, including credit facilities, are readily available for farmers and that adequate provisions are made for the marketing of their products;
- (viii) to develop measures to protect farmers from praedial larceny.

The policies and programmes for achieving the above objectives are summarized as follows:

- (i) the system of guaranteed prices, for those farm products for which an expansion of production is urgently required

will be continued. During 1977 the prices of 17 products were guaranteed at a level which provided a margin of profitability sufficient to encourage increased production. Appropriate revisions will be made to this list of products to ensure that the stated objectives are attained;

- (ii) the land reform and land use programme will be accelerated. In association with this, a number of integrated rural development projects will not only settle farmers and increase agricultural production, but will also provide improved infrastructure and social amenities. Under Project Land Lease 31,364 farmers were settled on 61,307 arable acres up to the end of 1977. An additional 15,000 - 20,000 new farmers will be settled on 58,700 acres during the Plan period. In addition, some 15,000 young farmers will be settled on a cooperative basis on 37,500 acres under the new Pioneer Farms Programme.
- (iii) a substantial irrigation programme will be implemented, thus removing one of the major constraints to increased agricultural productivity. An additional 59,000 acres of land will be brought under irrigation and irrigation facilities will be improved on another 15,000 acres.
- (iv) a major soil conservation programme will be implemented to protect the various watersheds and at the same time allow farmers to practice more intensive agriculture in these areas without increasing the risk of soil erosion. The programme for the next five years entails the treatment of 44,000 acres of land, while feasibility studies will be conducted to expand the programme to treat an additional 41,000 acres;
- (v) the Research and Extension Services will undergo major reorganization and strengthening to improve their capability to provide greater assistance to farmers in their various agricultural pursuits;
- (vi) major improvements will be undertaken in the marketing and distribution system for agricultural products, particularly domestic food crops. This will be achieved in collaboration with the Ministry of Industry and Commerce (particularly through the Agricultural

Marketing Corporation) and the Ministry of Local Government;

- (vii) the administration of agricultural credit will be improved to allow a greater flow of credit to all categories of farmers on a timely basis. The Jamaica Development Bank, acting in collaboration with the People's Cooperative Banks, is to become the principal agent for the disbursement of public-sector funds to farmers;
- (viii) various programmes, designed to instill confidence in the farming community, will be implemented to cover such areas as security of tenure and protection against praedial larceny. In addition, the role of private farms, state farms, Project Land Lease farms and Pioneer farms, will be clearly elaborated in the Agriculture Sector Plan.

The targets and strategies of the major programmes for achieving the agriculture plan objectives are outlined below:

- (i) Domestic food crops production will be expanded by an additional 90,000 crop acres over the five-year period. This additional acreage will come largely from more intensive land-use practices (multiple cropping, inter-cropping, and crop rotation) which will be facilitated as idle lands are brought into production through drainage, irrigation or the terracing of steep slopes. The target is to increase the output of domestic foods by some 278,000 tons over 1976 levels, with emphasis on the production of legumes, cereals (rice and corn) and vegetables.
- (ii) Cattle expansion is aimed primarily at development of the dairy industry to achieve self-sufficiency in milk and dairy products. The programme is targeted to produce an additional 20 million quarts of milk and 7,000 tons of beef by 1982. The programme will be facilitated by the conversion of bauxite lands from beef-rearing to dairying.
- (iii) Small Stock and Poultry development, involving sheep, goats, pigs, rabbits and poultry, is a rapid and relatively low-cost approach to expanding the

supply of animal protein. The programme is aimed at increases in production of 3.6 million pounds of goat flesh, 3.6 million pounds of mutton, 8 million pounds of pork, 5 million pounds of rabbit meat, and 65 million pounds of broiler meat. The small stock and poultry industry is extremely important in the generation of income and employment opportunities for small farmers, pioneer farmers and rural communities, and for import substitution in meat, as well as for the development of wool-craft and tanning industries.

- (iv) Fisheries development is based principally upon the expansion of the deep-sea fishing fleet by 30 vessels under public sponsorship and developing modern port facilities to handle the increased production. Output is targetted to expand by at least 6 million pounds by the end of the five-year period from off-shore fishing. Inland fish production in ponds, micro-dams and streams will be intensified and expanded to provide an additional source, and output is expected to reach 18 million pounds by 1982.
- (v) The coconut industry programme aims at establishing 35,500 acres during the five-year period (17,000 under the Rehabilitation Programme to replace trees destroyed by lethal yellowing disease and 18,500 acres of new plantings). Coconut plantations will be inter-planted with such crops as plantains, bananas, coffee, cocoa and pastures. Resuscitation of this industry is important for the support of local agriculture-based industry and for replacing imports. The programme is expected to yield an additional 10,000 tons of copra by the end of five years.
- (vi) The coffee industry programme provides for an expansion of 6,300 acres and resuscitation of 1,500 acres over the five-year period, which will produce an additional 800,000 pounds of clean coffee by the fifth year. This crop is an important earner of foreign exchange and finds a ready market with its high quality.
- (vii) The cocoa industry programme proposes the establishment of 1,245 acres of cocoa (with 1,200

acres of bananas as shade). This expansion will yield an additional 123.8 tons of cocoa beans by the fifth year. Cocoa is an important ancillary crop for small and medium-sized farmers, and, like coffee, Jamaican cocoa is of high quality and finds a ready export market.

- (viii) The sugar industry will undertake expenditures to improve the efficiency of its field and factory operations. Without any expansion in direct inputs of land or labour, production should increase by some 50,000 tons of sugar by the end of the Plan period, which would bring annual production up to about 400,000 tons.
- (ix) The banana industry aims at expanding production to reach 150,000 tons of export fruit by 1982. This will be done by expanding acreage under production by 8,500 acres and by replanting 15,000 acres. For the new plantings, the public-sector farms will expand from the present 2,500 acres to 7,000 acres, while the private-sector farms will expand by 4,000 acres. All new plantings will be under irrigation. For the replanting programme, 10,000 acres will be done under irrigation (6,500 acres by large farmers and 3,500 acres by small and medium-sized farmers) while the remaining 5,000 acres will be done under non-irrigated conditions by small farmers. The industry is being reorganized to increase its efficiency.
- (x) The spice industry (comprising mainly pimento and ginger but including also annato, tumeric, kola-nuts, blackpepper, sarsaparilla, cardamom and vanilla) is to be expanded by some 2,000 acres, ranging from 50 acres to 500 acres for the individual crops. This industry aims to take greater advantage of its potential as an earner of foreign exchange.
- (xi) Tree Fruits, except for citrus (treated separately below) have not been developed on a systematic basis in orchards in the past. These tree crops include such soft fruits as mangoes, avocados, ackees, guavas, pawpaws and otaheiti apple. The programme for the five-year period is aimed at the establishment of orchards on a cooperative basis

on Government-owned lands, totalling 2,300 acres with the five most popular fruit trees: mango, avocado, ackee, pawpaw and guava. This expansion will not only go towards meeting local fresh-fruit demand, but will also assist in the development of export markets, as well as agriculture-based industry.

- (xii) The forestry industry twenty-year programme aims at establishing 5,000 acres per year. During the Plan period, an additional 31,500 acres of forestry is to be established (20,000 in industrial plantations, 6,500 in private and community plantings and 5,000 acres of re-forestation). The land utilized for forestry is often in the hilly interior and not suited for any other purpose. More importantly, the activity is labour-intensive, has a high agro-industrial potential (saw-milling, particle board, pulp and paper) and plays an important role in soil conservation and watershed protection, while providing facilities for recreation.
- (xiii) The tobacco industry is to expand its acreage from 850 to 1,600 acres during the Plan period, with a resulting increase in output of more than 1.4 million pounds of tobacco leaf to bring the level up to 2.4 million pounds by 1982.
- (xiv) The citrus industry will undergo major reorganization during the Plan period. The programme for citrus entails the establishment of 4,400 acres of new plantings and the rehabilitation of 7,000 acres of existing orchards. These measures should produce an additional 4 million boxes of citrus fruit by the end of the five-year period.

The production programmes outlined above will be backed by programmes designed to provide the necessary infrastructural services, such as extension, credit and marketing, and institutional arrangements will be made to expedite the organization and development of cooperatives and Pioneer Farms.

In addition to these specific programs and targets for agriculture, there are a number of other programs which will directly affect agriculture. The Pioneer Farm Programme will be utilized to increase the employment of rural youth as well as increase food

production.¹ The long-term capacity in agriculture will be enhanced by expanding vocational agricultural education. By the end of the plan period, it is anticipated that approximately 14,000 10th and 11th graders will be enrolled in agriculture.² Irrigation works already funded will provide agriculture an additional 36 million gallons per day, and other projects are planned which will provide substantially more.³

In summary, the fundamental agricultural sector goals of Jamaica are:

- (1) a more equitable distribution of income and employment, implying reallocation of agriculture's basic resource, land, to small farmers;
- (2) increased production of food crops in order to conserve foreign exchange and reduce Jamaica's dependency;
- (3) expanded production of export crop through more efficient use of existing land and labor resources in order to increase foreign exchange;
- (4) improved nutritional quality of the Jamaican diet through expansion of the livestock industry, especially dairy products.

1. Ibid., p. I.25.

2. Ibid., p. I.29.

3. Ibid., p. I.35.

ANNEX III

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ANNEX IV

OFFICIAL VISITS MADE BY TEAM MEMBERS

Institutions Visited - Education

Ministry of Education, Kingston

University of the West Indies, Mona

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St. Catherine's High School, Spanish Town

Dinthill Technical High School, Linstead, St. Catherine

Munro College, St. Elizabeth

Elim Vocational Agriculture School, St. Elizabeth

Junction Secondary School, Junction, St. Elizabeth

Lacovia Secondary School, Lacovia, St. Elizabeth

Institutions Visited - Research

Ministry of Agriculture, Kingston:

Crops and Soils Department

Forestry Department

Livestock Department

Plant Protection Department

Veterinary Department

Planning Unit

Research and Development

Office of the Permanent Secretary

Institutions Visited - Research (Con't.)

Caribbean Agricultural Research and Development Institute

Scientific Research Council

Sugar Industry Research Institute (Mandeville)

Coconut Industry Board

Coffee Industry Board

Cocoa Industry Board

Banana Board

Agricultural Development Corporation

Inter-American Institute of Agricultural Sciences

Ministry of Agriculture Experiment Stations:

Bodles

Grove Place

Lawrencefield

Top Mountain

Orange River

Elim

Institutions Visited - Extension

Farmers Training Center, Twickenham Park

Training Division, Ministry of Agriculture, Kingston

Area Extension Office, Harry Watch, Mandeville

Regional Extension Offices (Mandeville; Kingston; Port Maria)

Extension Production Department, Kingston

Institutions Visited - Extension (Con't.)

Parish Offices in Maypen and Mandeville

Office of Subject Matter Specialists, Kingston

Office of Program Coordinator, Home Economics, Kingston

Peace Corps Office, Kingston

Agricultural Information Service, Kingston

Office of Permanent Secretary, Kingston

Office of Secretary Manager, 4H

Jamaica School of Agriculture

Other

Government of Jamaica/USAID Integrated Rural Development Project
at Two Meetings and Pindars

Government of Jamaica/IICA Hill-Farm Cropping Systems Project
at Allsides

Jamaica School of Agriculture

Several farming operations including small multicrop hill farms,
sugar estate, coconut plantation, banana farms, etc.

ANNEX V

PERSONS CONTACTED IN JAMAICA IN THE COURSE
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ANNEX VI

MINISTRY OF AGRICULTURE EXPERIMENT STATIONS¹

Lawrencefield

Located in St. Catherine Parish at an altitude of approximately 50 feet, the station has an area of 93 acres, most of which is irrigable. There is an office, a store room, an implement shed, and housing for three technicians. This is primarily a field crop research station, and work is being carried out with cassava, vegetables, legumes, sweet potatoes, castor beans, cotton, and other crops. The station also maintains a "museum" collection of avocados and mangoes and some pimento plantings.

Bodles

Located in St. Catherine Parish, Bodles is the best equipped and largest of the Ministry's stations and is designated as the major station in the reorganization plan. Situated at an altitude of approximately 50 feet, it includes 2,200 acres, approximately 500 of which are irrigable. Housing is available for 12-14 technicians. In addition, structures include a laboratory, livestock buildings, milk-~~ing~~ parlour, work shop, store rooms, and implement sheds. This station includes both a livestock (primarily dairy cattle) component and a crops component and will serve as the regional research station for the Southern Region.

Grove Place

Located in Manchester Parish at an altitude of approximately 1400 feet, the station includes 1800 acres, none of which are irrigated. Housing is available for four senior staff, five technical staff, and four laborers. Office buildings and implement sheds are also on the station. The station is primarily devoted to beef cattle and breeding work, although some work is carried out with citrus and coffee seedlings plus the introduction and testing of pasture grasses.

1. Prepared from personal visits and information contained in G. Barker, A. Wahab, and L. A. Bell, "Agricultural Research in Jamaica", Kingston: IICA, 1977, pp. 11-12.

Orange River

Located in St. Mary Parish at an altitude of 500-1000 feet, the station includes 305 acres of which 255 acres are operated by the Ministry and the remainder by the Banana Board. It has limited irrigation. Housing is available for four senior staff plus technical and service personnel. Other structures include an implement shed, an insectory, and buildings for small livestock. The station is primarily concerned with tree crops. Coconut propagation and distribution of lethal yellowing resistant seedlings (Malayan Dwarf) is carried out here. An area is also devoted to production of cacao and cacao research.

Beverly Pimento Station

Located in St. Ann Parish at an altitude of 300 feet, the station includes 31 non-irrigated acres. A cottage for the headman, plus two apartments and an office, comprise the structure.

Top Mountain

Located in St. Andrew Parish at an altitude of 3,500 feet, the station includes 13.0 acres, approximately 5 of which are terraced and irrigable. Structures include a cottage and a seed and implement room. The work at this station is principally with vegetable crops and fruits. Coffee propagation is also accomplished here.

ANNEX VII

SUGGESTED EXTERNAL ASSISTANCE PROJECTS

The University of Kentucky contract requires the identification of potential assistance projects, with special emphasis on those that could involve activities under Title XII of the U.S. Foreign Assistance Act.¹ These projects are presented more or less in their order of priority. The projects are all related and could be aggregated into a lesser number of projects or even into one project. They are presented as separate projects in order to prioritize the components, and because they fall into a fairly logical sequence with the scope of the latter stages being dependent upon the accomplishments of the earlier stages. It should not be inferred that the projects suggested will form the total needs for assistance to the REE system. It is assumed that the government will be taking on more direct agricultural developmental projects such as the 1st and 2nd Integrated Rural Development Projects, and that such projects will both make demands on the REE system and provide a basis of strengthening this system.

Although it is not the function of the baseline study to develop assistance projects, the first two projects are discussed in sufficient detail to provide a concept of magnitude. For this purpose, an arbitrary time span of 5 years is assumed. It is clearly necessary for these activities to be continued beyond this time; but the magnitude and emphasis may change, and later stages could, if desired, be incorporated into the other projects suggested.

Project 1 - Strengthening J.S.A.

JSA is the principal Jamaican institution for higher agricultural education in Jamaica. Its graduates form the backbone of the technical manpower located in agriculture, with large numbers of graduates being employed in extension service and vocational agricultural teaching. In addition JSA graduates go on to degree level work at U.W.I. and at other institutions. Unless a completely new institution is to be formed, the development of Jamaican agriculture in accordance with national goals is dependent upon the performance of JSA. The school is at a transition point now; and, provided that a Jamaican consensus on its role and goals can be developed, it should be given highest priority for both internal and external developmental support.

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1. These summary project proposals were prepared by the University of Kentucky team. Neither the Government of Jamaica nor USAID has made any commitment to their implementation.

Background

JSA was developed to provide trained agricultural technicians for the export crop industry and for the Jamaican Agricultural Society. The emphasis was on practical agricultural production using known technology. In more recent years the curriculum has included more science, especially for students intending to pursue a degree program elsewhere. Also, home economics and educational methodology courses have been added for those students being prepared for secondary school level teaching. These changes and additions, loss of farm land to other governmental agencies, and perhaps some lessening of interest on the part of faculty and students have resulted in less practical training for the students.

JSA now seems to be under attack from several quarters. Many claim that JSA graduates today are less well-trained in practical agriculture than in the past. The loss of JSA lands and the relatively low budget increases may indicate a lack of governmental support for JSA, or a lack of confidence in the schools administration to successfully operate the institution. There are charges of poor financial and personnel management. A large number of non-professional staff appear to be underemployed, and the school is in debt and can barely operate day-to-day, much less correct its serious maintenance and operational problems.

The school is at a crossroads. If the present dissatisfaction and the discussion caused by it result in a more clearly defined role and sharpened goals for JSA, it will work to the advantage of the school. There is nothing basically wrong with the school that cannot be remedied by reasonable measures.

Problem Statement

The basic complaints about JSA have some merit. It is probably true that today's JSA graduates have less practical knowledge than those in the past. However, it must be considered that the agricultural situation confronting the new extension worker today is much more complex than that of the past. Graduates are expected to be knowledgeable not only about export crop production but also about a wide variety of temperate crops plus livestock, government credit and subsidy programs, etc. Jamaica, although a small country, has a very wide variety of both tropical and temperate zone agricultural enterprise. It has very large farms and one acre farms. There is a limit to the practical knowledge that can be expected of a graduate of a 2 or 3 year program. One must also be aware of the need for the agricultural officer to be able to synthesize answers to problems that he has not faced before. This requires both knowledge and an understanding of basic agricultural sciences.

During the past few years JSA student enrollment has been increasing more rapidly than has the budget. The 1975-76 budget was J\$3200 per student and the 1978-79 budget was J\$3000 per student. During this same period, inflation was 100%. Thus, the constant dollar support calculated in 1975 dollars decreased 53% from 1975 to 1978. Under these circumstances, it is clear that all of the school's fiscal problems cannot be ascribed to poor management. Nevertheless, it is also apparent that the school has too many non-professional staff in absolute terms. The number is even more excessive if considered in view of the level of funding available for supplies, equipment, etc. as contrasted to that which would be required for full utilization of the employees.

The loss of JSA lands has created additional serious problems. The buildings are located on rocky land of little agricultural use, but the good agricultural land is inadequate for maintenance of animal herds and is highly subject to praedial larceny due to the general urbanization of the area. It appears unlikely that JSA will be able to regain land or even maintain land at its present location. The possible solution to this problem and to the problem of facility needs for increased enrollment are discussed in Project No. 4.

Improvement of JSA will require a multifaceted project. The most important aspect of this is faculty improvement, but the more mundane problems of JSA must be solved if it is to keep and effectively utilize a better trained faculty. Thus, the improvement program should involve:

1. Development of a clearly articulated role for JSA and a staged developmental plan;
2. Development and implementation of a plan for renovation and essential additions to the physical facility;
3. Development of an adequately budgeted management and operations organization and staff;
4. Development of curricula, course outlines, and other instructional guides for implementation of 1 above;
5. Provision of textbooks and reference materials and provision of classroom, shop, field, and laboratory equipment;
6. Faculty training, to the B.S., M.S., and Ph.D. levels;
7. Technical assistance in planning and implementing

developmental plans, in training faculty and staff, and in developing improved courses, teaching materials, and teaching methods.

This project would be suitable for a collaborative style Title XII project. The planning functions would be accomplished during the first stage, with implementation to follow.

Output expected

1. A developmental plan for JSA designed with inputs from concerned ministries, faculty, staff, students, and local and expatriate experts;
2. A curriculum and course content tailored to the resources of JSA and the training needs of the students;
3. A renovated and operational physical plant;
4. A faculty capable of providing modern instruction in both practical agriculture and the agricultural sciences.

Inputs required

1. 19-man years of technical assistance in planning and implementation, curricula development, training instruction, and course development;
2. 20 man-years of training to the B.S. level;
3. 26 man-years of training to the M.S. level;
4. 20 man-years of training to the Ph.D. level;
5. 90 man-months of short term training abroad;
6. 85 man-months of in-service training;
7. Renovation and upgrading of physical facilities - US\$2,000,000;
8. Books (10,000 volumes) US\$150,000;
9. Laboratory equipment - US\$130,000;
10. Classroom equipment - US\$45,000;
11. Audio-visual equipment - US\$10,000;

12. Field equipment - US\$30,000;
13. Library and office equipment - US\$35,000;
14. Maintenance equipment - US\$30,000;
15. Adequate operational budget for JSA.

Project 2 - Development of Manpower in the Research and Extension System

The primary emphasis in this program is training. Two facets are envisioned: (1) primarily external training for research and extension officers with the main objective of having persons with M.S. level degrees in the positions requiring these degrees. Some training to the B.S. level or to the Ph.D. degree level would be provided under certain circumstances. (2) primarily in-country short-course training for extension (and perhaps some research) personnel designed to provide training on (a) extension methodology; (b) project planning, implementation, and evaluation; and (c) discipline or commodity subject matter.

Background

The reorganization of extension and research activities in the Ministry of Agriculture has resulted in a structure under which it is feasible to undertake the programs needed to achieve national goals. There is, and will continue to be, a shortage of suitable trained research and extension specialists; and there is a great need for upgrading the general level of training for extension officials to compensate for deficiencies in training, for changes in Jamaican agriculture, and for the greater demands of tasks now being assigned.

Problem Statement

For external degree training, the first step is to identify the needed fields of expertise and to locate suitable candidates within these fields. Arrangements must then be made for admission of candidates to suitable institutions of higher education. It is contemplated that most candidates will be seeking the M.S. degree, and it should be required that all higher degree candidates complete a research thesis. Whenever feasible, the thesis research should be done in Jamaica. This is more expensive but will be a good investment in the long run. Completing the thesis in Jamaica may require that the student's major professor visit Jamaica at least once and will certainly require assurance that the student will have adequate resources for timely

completion of his research in Jamaica. Conducting research in Jamaica is advantageous because the research done, if selected appropriately, will be of direct benefit to Jamaica. A second advantage is that the research done in Jamaica can provide an example for students, research assistants, and other potential research officers. Some non-degree external training would be undertaken primarily to take advantage of short-courses offered by USDA, Universities, FAO, International Centers, etc., on subjects of great importance and direct relevance to Jamaica. External help would be needed for technical assistance, participant-ships, and costs associated with performing the research in Jamaica.

For the in-country short-course training program, the first step would be identifying specific training needs. Next, it would be necessary to locate suitable instructors and schedule the courses. In selecting instructors, MINAG personnel would be considered first; next other Jamaican sources, and finally external sources. In many cases some combinations of these would be derivable. Specific topics would need to be selected but might include: communication; extension methodology; project planning, implementation and evaluation; management; discipline areas such as plant nutrition and fertilizer use, cropping systems, integrated pest management; and commodity topics such as goat production, rice production, or oil seed production. Technical assistance would be needed for planning and scheduling. Funds for travel and living expenses for participants, instructors, salaries, and instructional equipment and supplies would be required.

Output expected

A more capable and better functioning agricultural research and extension program through:

1. Training of 20 research officers to the M.S. level;
2. Training of 5 research officers to the B.S. level;
3. Training of 5 research officers to the Ph.D. level;
4. Training of 20 research or extension officers in special short-courses abroad;
5. Training of 10 extension officers to the M.S. level;
6. Training of 10 extension officers to the B.S. level;
7. Training of 400 extension officers for each of 4 years in at least one in-service short-course of 1-4 weeks duration;

Inputs required

1. 5 man-years of long-term technical assistance;
2. 80 man-months of expatriate short-course instruction;
3. 80 man-months of Jamaican short-course instruction;
4. 110 man-years of long-term participant training;
5. 100 man-months of short-term participant training.
6. Office assistance - one staff assistant, one secretary, two typists, and one driver;
7. Office and training equipment - US\$100,000;
8. Transportation - 1 passenger car, one 4-wheel drive vehicle, and one 30-passenger bus;
9. Operating expenses, US\$30,000 1st year, US\$65,000 per year for 4 years;
10. Office space, 1400 sq. ft.; classroom space, two with 800 sq. ft. each;
11. Travel and living expenses for 1600 extension officers . . . (400 per year for 4 years) for an average of 10 days each.

Project 3 - Expansion of Extension Programs

The primary emphasis in the program would be to provide facilities and equipment to make it possible to more efficiently utilize the upgraded extension staff which would be developing from Projects 1 and 2. This project could be combined with Project 2 as it supplements it.

Background

Many extension officers do not have suitable transportation for visiting farms, attending training seminars or field days for farmers, transporting materials for field demonstrations, or bringing educational materials or equipment to meetings. Regional training centers for farmer training do not have adequate facilities for lecture or laboratory demonstration, projectors cannot be used because rooms

cannot be darkened, audio-visual equipment is missing or worn out, and, in general, training methods other than lecture or discussion cannot be used. Regional extension officers have no library facilities other than the personal materials of officers. Thus, officers are not able to make full use of Jamaican research, studies, etc., much less of work done elsewhere.

Discussion

Transportation problems could be alleviated to some degree by provision at division headquarters of at least one suitable vehicle which would be available to area officers on a rotating basis. This would require about 65 vehicles. Training centers need to be replaced or refurbished; the necessary equipment supplied; and where alternate facilities are not available, simple sleeping and dining quarters provided for 20-25 trainees. Learning resource centers would have to be built; equipped with copying, duplicating, and micro-film equipment; and stocked with the most commonly used reference materials. Some efficiencies of operation could be made by locating training centers and learning resource centers together. Further efficiencies could be obtained by locating both of these at research stations or vocational schools. The feasibility of such aggregation would have to be determined on a region-by-region basis.

Project 4 - An Enlarged Facility for the Jamaica School of Agriculture

It is clear that JSA will require additional facilities if it is to meet the manpower needs of Jamaica. The primary emphasis in this project is on facilities. This assumes that JSA will solve its management problems, by being given a clear mandate as to its role, that this mandate will include its continuation as the foremost institution for agricultural education in Jamaica, and that Project 1 will be in the process of implementation.

Background

According to past reports which were corroborated by this study, the facilities of JSA are being used at or above the optimum. The presently planned extension of the 2 year diploma program to 3 years will further tax these facilities. Manpower needs indicate that JSA will need to at least double the present output of graduates, and that there is a need for more B.S. level graduates than are now returning from training abroad. Expansion of the number of diplomates or addition of a B.S. level program will require additional facilities. Furthermore, JSA farm land has been converted to other uses and is now inadequate for student training needs. It is clear that while renovation and modest

expansion of JSA facilities are needed immediately, this will not provide adequate facilities for longer than 2 to 4 years.

Discussion

The pattern for improvement of facilities at JSA will have to wait for resolution of some of the present questions concerning the role and expected output from JSA. At this time, several alternatives appear possible:

1. Develop a new campus with adequate facilities.
2. Maintain the present campus by building adequate classroom, laboratory, dormitory, and support facilities, but do the practical work elsewhere at satellite campuses set up for this purpose.
3. Maintain the present campus by building adequate classroom, laboratory, dormitory, and support facilities, but do the practical work at existing or new facilities located at research stations, vocational secondary schools or similar locations offering adequate opportunities.
4. Build a second campus with adequate farm facilities for practical training, with dormitories, and with classrooms and laboratories for basic-agricultural courses. The students might spend the first year at the present site taking basic science courses and learning agricultural skills, the second year at the new site taking practical field work and basic agricultural courses and the third year back at the present site taking advanced agricultural courses. If a 4-year course were developed, the stay at the second campus could be lengthened to 2 years. The present campus is fairly close to the southern research station at Bodles, and this might allow the use of Bodles staff and facilities for some of the advanced courses.

Project 5 - Research Facilities

Research facilities are inadequate for the research needs of Jamaica. Problems include lack of field laboratories, lack of adequate library facilities, lack of equipment, lack of personnel, and lack of adequate security. The need for upgrading of facilities is fully recognized.

Background

Under the IDB Agricultural Research Loan Project, the Ministry of Agriculture is receiving assistance for developing two research stations, one at Bodles for the southern region and one at Montpellier for the western region. The Bodles station will to some degree serve as the main station and will have the most complete laboratory facilities. It will concentrate on crop production, while the western station will concentrate more on forage and livestock production. Each will have several substations, and each will have resident research officers. Long-range plans call for development of a third station in the northern region and possibly eventually a fourth station in the central region. The IDB project provides a limited amount of technical assistance and training of staff, but the training component is probably inadequate.

Discussion

It would be premature to suggest the degree and type of assistance needed for the third station, but it is clear that another station will be needed. The Bodles location will not provide for the soil and climatic conditions of the northern or northeastern hilly regions. Careful evaluation of the progress and operation of the first two stations will provide a basis for outlining this project.

This project could provide a sequence to, or an extension of, the training project listed as No. 2. Training for research workers will need to be continued at least for an additional 5 year period, either by incorporation in this project, by an extension of the training project, or by incorporation in project No. 6.

Project 6 - Technical Assistance in Research Program Implementation and in Extension Methodology

By the time this project is initiated, the research and extension sectors will have benefited from earlier projects and will have the capability for significant program upgrading. The work proposed in this project could be included in earlier projects, but it may also be considered as a separate activity.

Background

At the time of writing this document, the research and extension section are undergoing reorganization. This reorganization is a result of changes in both the direction and extent of activities expected from these sectors. For these changes to be effective, facilities and staff will have to be upgraded. Projects 2, 3, and 5 focus on these needs.

As activities under these projects begin to show results, the emphasis should shift to activities which further develop capabilities by focusing on results rather than on the means of obtaining results. The capability to shift program focus without losing momentum is the measure of a self-sustaining research or extension program.

Discussion

It would be premature to suggest the actual activities which might be initiated 5 years in the future. As an example, however, the problem of animal production in Jamaica might be mentioned. At present, Jamaica must import animal products and animal feed. Both are expensive. Crops can be produced in Jamaica (cassava, for example) which could replace much imported grain. However, with present technology Jamaican farmers cannot produce cassava cheaply enough to compete with imported grain. Hence, the government is faced with loss of foreign exchange for feed grain importation or that of higher costs for meat if feed grain imports are stopped. The development of animal production systems which produce animal products at affordable prices and minimize feed imports will require innovative approaches in agronomic, animal science, economic, and sociological research, as well as in extension methodology. A dozen other possibilities could be mentioned but would serve no useful purpose. By the time the research and extension sectors develop the capability to undertake such programs, the specific needs of today may no longer be pertinent, but others will have replaced them.

Technical assistance will be useful for implementation of such programs. Appropriate expatriate scientists can bring to bear the ongoing research of other national and international programs, can serve to focus efforts in Jamaica, and can be effective in training young scientists and potential scientists. They can be especially effective in assisting Jamaican graduate students who are conducting thesis work in Jamaica.

This project, together with Projects 2, 3 and 5, could constitute a suitable sequence of projects for consideration under Title XII of the U.S. Foreign Assistance Act.

