Managing Scientific Information to Meet the Changing Needs of Agricultural Research in Trinidad and Tobago

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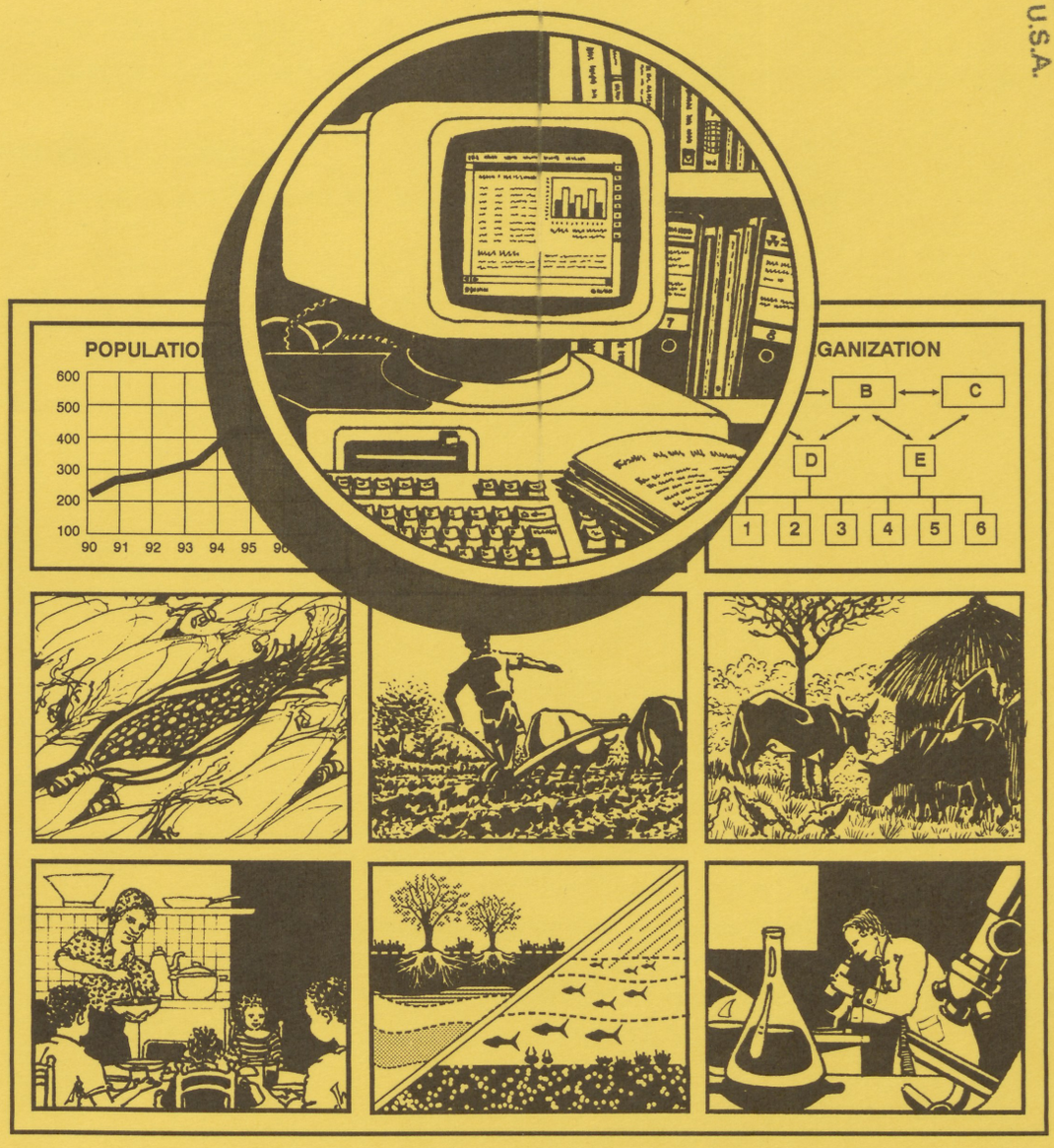

isnar SMALL-COUNTRIES STUDY PAPER # 3

The International Service for National Agricultural Research (ISNAR) began operating at its headquarters in The Hague, the Netherlands, on 1 September 1980. It was established by the Consultative Group on International Agricultural Research (CGIAR), on the basis of recommendations from an international task force, for the purpose of assisting governments of developing countries in strengthening their agricultural research. It is a nonprofit, autonomous agency, international in character and nonpolitical in management, staffing, and operations.

Of the 16 centers in the CGIAR network, ISNAR is the only one that focuses primarily on national agricultural research issues. It provides advice to governments, upon request, on research policy, organization, and management issues, thus complementing the activities of other assistance agencies.

ISNAR has active advisory, research, and training programs.

ISNAR is supported by a number of the members of the CGIAR, an informal group of donors that includes countries, development banks, international organizations, and foundations.

CTA

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STUDY PAPER #3

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AGROVOC Descriptors

information services; management; research; Trinidad & Tobago

CARIS Descriptors

agricultural research; information services; management; research; Trinidad & Tobago

Contents

ISNAR Small-Country Project

Introduction

In 1989, ISNAR began a global study of agricultural research systems in small, low-income developing countries with populations of fewer than five million people. Because of resource limitations and the inherent constraint of size that restrict the scale of the research effort in these countries, their national agricultural research systems (NARS) are small — often under 50 researchers. Nonetheless, these NARS have varied and complex tasks to perform in their respective countries.

The major goals of this study are to identify the strategic role of NARS in small countries and to determine how essential research tasks can be carried out in small research systems. Several cases are to be examined in depth, and for these, the study will assess the research capacity and resources that are currently available or needed to conduct agricultural research. This is examined in light of their mandates under the agricultural development policy of their respective countries, as well as requirements for conserving the country's natural resource base.

The project is funded largely by the Italian Government with additional support from the Rockefeller Foundation, the Danish International Development Agency (DANIDA), and the CTA (Technical Centre for Agricultural and Rural Cooperation, ACP-EC Lomé Convention).

Objectives

- To create and maintain a data base on 50 small countries, containing information on their agricultural research needs and national agricultural research systems.
- To devise means of measuring and classifying key factors related to agricultural research so that the NARS of small countries can be analyzed and compared. Such factors include agroecological zones, the scale of research systems (e.g., human and financial resources, sizes and types of institutes, types and quantity of local research programs), internal demand for technology, external sources of information on new technologies, and linkages to those sources.
- To identify suitable organizational models for NARS, as well as mechanisms and strategies for setting priorities and allocating resources to research.
- To evaluate national and regional research environments so as to help small countries exploit opportunities for acquiring new technologies from outside.
- To identify and assess mechanisms that enable NARS to manage their links with policymakers, local producers, and external sources of knowledge and technology.
- To identify the skills needed by small-country research leaders to manage the alternative strategies open to them.

Project Activities

A Global Data Base on NARS in Small Countries

Fifty developing countries are included in a global data base on agricultural research needs and the state of the NARS. These countries have populations of less than five million (1980 census) and meet at least three of the following four criteria:

- The economically active agricultural population is 20 percent or more of the total economically active population.
- Per capita income is less than US$2,000 (1980 US constant dollars).
- AgGDP per capita for the economically active agricultural population is less than US$2,000.
- AgGDP is 20 percent or more of GDP.

For each country, this information will be used to assess the national demand for research as well as existing national research capacity. The data base should provide cross-country indicators of common constraints, options, and trends.

Country Case Studies

Honduras, Jamaica, Sierra Leone, Togo, Lesotho, Mauritius, and Fiji have been selected for in-depth study. The studies cover institutional development, research organization and structure, external linkages, and information flows to the country.

Regional Studies

Regional studies will be conducted in parts of West Africa, the Caribbean, and the South Pacific. The goal of the regional studies is to assess research capacity in regions where small countries predominate. The regional studies will also identify mechanisms and strategies by which national systems can increase their effectiveness and efficiency and gain access to the information and technology they need. The studies will consider the division of labor between NARS in a regional context as well as the role of regional research organizations and collaborative networks.

Methods and Concepts

The ISNAR project will develop methods for analyzing research needs and capacity in small countries. These will identify key issues and employ the following concepts:

- **Scale:** the inherent research capacity of a national system: the combination of a NARS's human and financial resources, knowledge base, and infrastructure.
- **Scope:** the institutional agenda of a NARS, the set of research topics and objectives to which it is committed. Scope has two dimensions: the range of research programs and the level of sophistication of the research.
- **Technology Gradients and Information Flows:** the varying intensities and levels of complexity in technology generation among national systems and the network of information exchange. An analysis of structure and levels of technology generation and transfer in a region is crucial for guiding the flow of information to smaller research systems. The study of gradients and flows also examines the capacity NARS must have in

place to have access to the technology and information they need.

- **Linkages:** linkages to institutions and systems outside the NARS itself. The study will explore two key sets of linkages that are essential for the national agricultural research system. The first includes linkages to policymakers and to farmer knowledge systems in the country. The second includes linkages to external sources of knowledge, technology, and resources.

Managing Scientific Information

In collaboration with the CTA (Technical Centre for Agricultural and Rural Cooperation, ACP-EC Lomé Convention) and agricultural research information specialists from developing countries, a study is underway to explore the management of scientific information in small research systems with limited resources.

Access to scientific information that is relevant to the development of objectives and appropriate to the conditions of developing countries is crucial for agricultural research systems. It is particularly critical in small countries because the resources to do all the research that farmers need are not always available. The scope of research in a country can be increased through effective information management. Information can also be used to supplement or replace some kinds of research, releasing scarce resources to be used for programs that must be conducted locally.

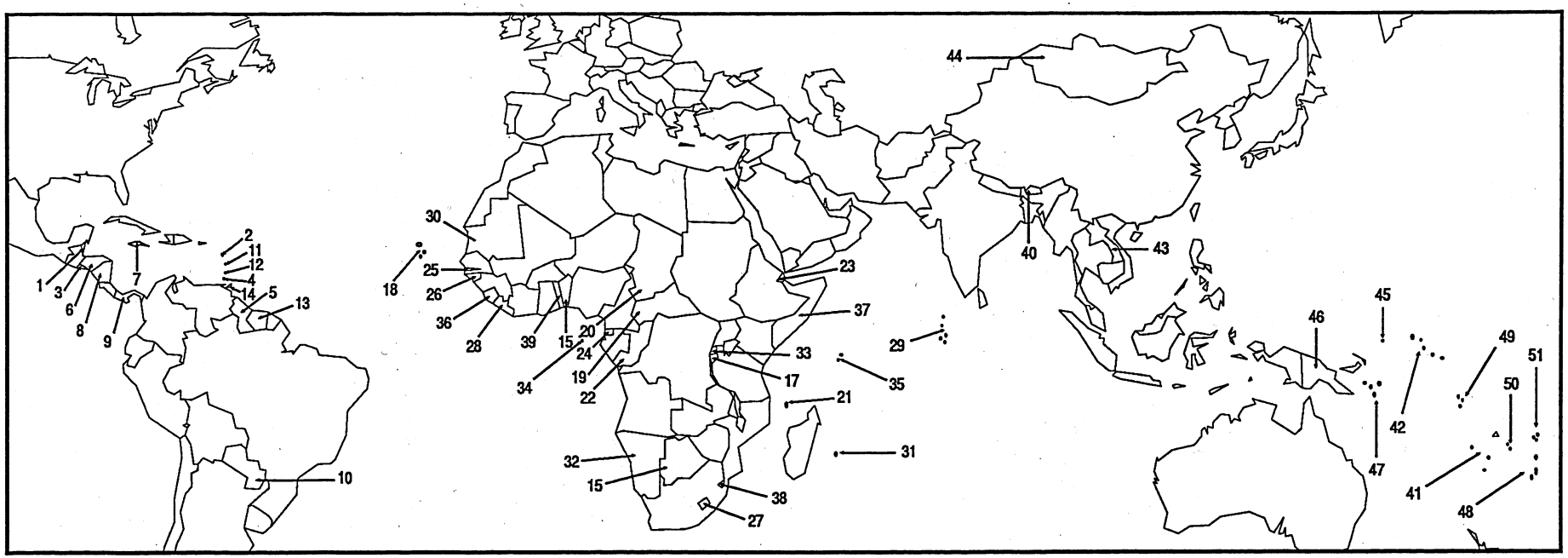
NARS in small countries are often limited in their ability to identify and receive the information they need to conduct adaptive and resource management research. This study will assess and propose mechanisms for identifying and obtaining scientific information for research programs in small countries. It will then focus on mechanisms of managing this information.

Dissemination of Results

Seminars/Workshops: Workshops are the key to disseminating the results of this study. The first workshop, held in The Hague in January 1990, reviewed project methodology and began implementation of country and regional studies. When the main phase of the study is complete, a global workshop of research leaders from small developing countries will be held. At this workshop, the conclusions of the study will be validated and applied.

Advisory Service and Training: In collaboration with national and regional agricultural research organizations, the methods developed in the study will be used for strategic planning and to produce improved management techniques for small research systems.

Publications: The data base, case studies, and issues papers will be published and made available to agricultural research managers, scientists, and development agencies concerned with agricultural growth and sustainability in developing countries.



Small Countries (as Defined by this Project)

Latin America and Caribbean:

1 Belize
2 Dominica
3 El Salvador
4 Grenada
5 Guyana
6 Honduras
7 Jamaica
8 Nicaragua
9 Panama
10 Paraguay
11 St. Lucia
12 St. Vincent
13 Suriname
14 Trinidad and Tobago

Africa and the Indian Ocean:

15 Benin
16 Botswana
17 Burundi
18 Cape Verde
19 Central African Republic
20 Chad
21 Comoros
22 Congo
23 Djibouti
24 Equatorial Guinea
25 Gambia
26 Guinea-Bissau
27 Lesotho
28 Liberia
29 Maldives
30 Mauritania
31 Mauritius
32 Namibia
33 Rwanda
34 Sao Tome e Principe
35 Seychelles
36 Sierra Leone
37 Somalia
38 Swaziland
39 Togo

Asia and the Pacific:

40 Bhutan
41 Fiji
42 Kiribati
43 Laos
44 Mongolia
45 Nauru
46 Papua New Guinea
47 Solomon Islands
48 Tonga
49 Tuvalu
50 Vanuatu
51 Western Samoa

Preface

The basic hypothesis underlying this study is that research in small countries is different from research in large countries: in the way it is organized and managed, in the amount of resources available to it, and in its priorities and orientation. These differences suggest that the role of information services for research in small countries will also be different.

In general, small developing countries do not have sufficient capacity in research to generate the knowledge and information that their agricultural sector requires. They must therefore rely on external institutions for much of their technology and information needs. This suggests that research systems in small countries must have the capacity in the system to scan, identify, evaluate, and acquire potential technologies or knowledge about them. Without this capacity, they will be unable to obtain what they need. The issue for research managers is to determine what resources and efforts are required to build the capacity that their system needs.

This case study is part of a joint ISNAR and CTA project entitled "Managing Scientific Information in Agricultural Research Systems in Small Developing Countries." Its objective is to identify mechanisms and strategies that can be used by agricultural research systems in small developing countries to gain access to relevant scientific information. Four case studies of national experiences in Mauritius, the Seychelles, Swaziland, and Trinidad and Tobago have been commissioned by the project. They each provide a description and a basis for discussion of information approaches to support agricultural research in each country. These will form the basis for further discussion with research managers and information specialists, and they will be incorporated into guidelines on how best to organize scientific information systems in small countries.

This case study is not intended to be a prescription for information development in Trinidad and Tobago; instead, it is a study of information services in relation to the research system that they serve. The intention is to learn from Trinidad's experience and disseminate the lessons to a wider audience. At the same time, major information issues that need to be addressed by research managers and information specialists are raised and discussed. Any subsequent changes or modifications to the systems and services are for national staff to debate and implement if appropriate.

Acknowledgements

The assistance and contribution of the following people are particularly acknowledged: Mr. W. Rudder, Permanent Secretary, and Dr. S. Howard, Director of Research, and his staff in the Ministry of Food Production and Marine Exploitation; the Director, Dr. T. Carr, and staff of Caroni Research Station; the Director, Mr. F. Neckles, of the Sugarcane Feeds Centre; Miss S. Evelyn, University of the West Indies Library; Professor L. Wilson, the Dean of the UWI Faculty of Agriculture; Ms. S. Manjoo, Documentalist, Caribbean Agricultural Research and Development Institute; Dr. P. Eyzaguirre, Ms. K. Sheridan, and staff of ISNAR. Thanks also to Ms. Y. Morean in Centeno and Ms. S. Gardner in The Hague who made sure that our own information services ran smoothly and effectively during the period of the study. Financial and professional support from CTA is gratefully acknowledged.

Abstract

This case study discusses the approaches used by the agricultural research system of Trinidad and Tobago to obtain and manage scientific information. Information access is reviewed in relation to the demand for information by the research system, the sources of information that it has access to, and the mechanisms used to actually obtain and manage the information. The most influential characteristic of demand is the need for the research system to respond to rapidly changing agricultural production priorities and interests — information services in the country must remain abreast of changing priorities and they must develop resources and services that are flexible enough to cope with rapid changes in subject focus. Libraries, information centers, research seminars, and information networks are the only mechanisms in which the research system has consciously invested. Personal contacts between researchers are the most frequently used mechanism; research networks are the least-used mechanism, at least in any systematic way. Major issues raised by the study include the way information units respond to changing demands for their services, the need for closer contacts with research management and priority-setting mechanisms, how information units deal with competing demands for their resources that arise from their multiple functions, the value of management commitment and high visibility, the role of the private sector, collaboration and coordination of information efforts, information technology, participation in regional and international networks and activities, and the qualifications and skills required of information personnel.

Résumé

Cette étude de cas analyse les approches utilisées par le système de recherche agronomique de la Trinité et Tobago pour obtenir et gérer l'information scientifique. L'accès à l'information est examiné par rapport à la demande d'information émanant du système de recherche, les sources d'information auxquelles il peut accéder et les mécanismes qu'il utilise pour obtenir et gérer l'information. La caractéristique principale qui détermine la demande est la réaction du système de recherche aux changements rapides des priorités et des intérêts de la production agronomique — les services nationaux d'information doivent être au courant des changements qui interviennent au niveau des priorités et développer des ressources et des services qui soient suffisamment flexibles pour s'adapter aux changements rapides au sein des thèmes.

Le système de recherche n'a utilisé — de façon consciente — que les mécanismes d'information suivants : les bibliothèques, les centres d'information, les séminaires de recherche et les réseaux d'information. Les contacts personnels entre les chercheurs sont les mécanismes les plus utilisés; les réseaux de recherche sont les mécanismes les moins utilisés, du moins de façon systématique. Parmi les principaux thèmes traités dans cette étude figurent la réaction des services d'information face aux changements de la demande de leurs services; le besoin de développer des meilleures relations avec la gestion de la recherche et l'établissement des priorités; la manière d'affronter le problème de la demande, de plus en plus compétitive, des ressources des services d'information, vu la multiplicité de ses fonctions; l'importance de l'engagement et d'une bonne visibilité de la gestion; le rôle du secteur privé; la collaboration et la coordination des efforts de l'information; la technologie d'information; la participation dans des activités et réseaux régionaux et internationaux ainsi que les qualifications et compétences que le personnel de l'information doit avoir.

Resumen

Este estudio de caso analiza el planteamiento que el sistema de investigación agrícola de Trinidad y Tobago utiliza para obtener y manejar la información científica. Esta información es analizada y actualizada con relación a la demanda de información del sistema de investigación, su acceso a las fuentes de información y los mecanismos que utiliza para obtener y manejar dicha información. La característica más resaltante de la demanda se centra en la necesidad de responder al cambio contínuo de prioridades e intereses de la producción agrícola, donde los servicios de información del país puedan mantenerse al día con los cambios en las prioridades y donde los recursos y servicios puedan adecuarse a los cambios y satisfacer las diferentes necesidades.

Hasta el momento, el sistema de investigación sólo ha utilizado los siguientes mecanismos de información: las bibliotecas, centros de información, seminarios de investigación y redes de información. El contacto personal entre los investigadores es el mecanismo más utilizado; el mecanismo menos utilizado, o al menos no de forma sistemática, son las redes de investigación. Entre los temas principales identificados en este estudio están: como los servicios de información responden ante el cambio en la demanda de sus servicios, como mejorar los vínculos con la dirección de la investigación y con los mecanismos para establecer prioridades, como afrontar el problema de la demanda de recursos, cada vez más competitiva, a raíz de las funciones múltiples que abarcan los servicios de información, la importancia del compromiso y la visualización de parte de la dirección, el papel del sector público, la colaboración y organización conseguida a raíz de los esfuerzos del sistema de información, la tecnología de la información, la participación en actividades desarrolladas en redes regionales e internacionales, y las calificaciones y experiencia con las que el personal de información debe estar capacitado.

Acronyms

AGRIS	International Information System for the Agricultural Sciences and Technology (FAO)
ASFIS	Aquatic Sciences and Fisheries Information System
CARDI	Caribbean Agricultural Research and Development Institute
CAGRIS	Caribbean Information System for the Agricultural Sciences
CAMIS	Caribbean Market Information System
CARAPHIN	Caribbean Animal and Plant Health Information Network
CARICOM	Caribbean Community
CARIRI	Caribbean Industrial Research Institute
CARIS	Current Agricultural Research Information System (FAO)
CARISPLAN	Caribbean Information System for Economic and Social Planning
CARTIS	Caribbean Trade Information System
CD-ROM	compact disk—read-only memory
CIAT	Centro Internacional de Agricultura Tropical
CIP	Centro Internacional de la Papa
CRIN	Caribbean Rice Improvement Network
CRS	Caroni Research Station
CRU	Cocoa Research Unit
CTA	Technical Centre for Agricultural and Rural Cooperation
ECIAF	Eastern Caribbean Institute of Agriculture and Forestry
FAO	Food and Agriculture Organization of the United Nations
FISMIS	Fisheries Management Information System
IARC	international agricultural research center
IBPGR	International Board for Plant Genetic Resources
ICGT	International Cocoa Genebank, Trinidad
ICTA	Imperial College of Tropical Agriculture
IDB	Inter-American Development Bank
IDRC	International Development Research Centre
IICA	Instituto Interamericano de Cooperación para la Agricultura
IMA	Institute of Marine Affairs
INIBAP	International Network for the Improvement of Banana and Plantain
IRRI	International Rice Research Institute
ISNAR	International Service for National Agricultural Research
MFPME	Ministry of Food Production and Marine Exploitation
NIHERST	National Institute of Higher Education, Research, Science and Technology
R&D	research and development
RISPAL	Red de Investigación en Sistemas de Producción Animal de Latinoamerica
SFC	Sugarcane Feeds Centre
UN	United Nations
UWI	University of the West Indies
VDL	Veterinary Diagnostic Laboratory
WAICENT	World Agricultural Information Centre
WICSCBS	West Indies Central Sugar Cane Breeding Station
WINBAN	Windward Islands Banana Growers Federation
WITCO	West Indian Tobacco Company

Agriculture and Agricultural Research

The two islands of Trinidad and Tobago are located off the northeast coast of Venezuela and comprise some 5,100 square kilometers. The total population in 1990 was 1.2 million people.

Until the discovery of oil in the 1920s, export agriculture based on cocoa, sugar, bananas, and citrus was the base for Trinidad and Tobago's economy. The growing dominance of the petroleum sector, the associated shift of labor away from agriculture, and the decline in world market prices for agricultural export commodities radically altered the agricultural sector. Export crops such as sugar became increasingly noncompetitive in the world market as labor costs spiralled and there were increasing demands to diversify to other commodities. It was not until the 1980s, however, with the decline in oil prices and revenues (that paid for food and agricultural imports), that serious efforts at import substitution and diversification began. Agriculture's contribution to the economy is growing slowly and reached 3.1% in 1989.

National and sectorial development plans at the time of independence in 1962 stressed the need for more emphasis on food production to meet local needs. The recent framework for economic development (National Planning Commission 1990) highlights the growing importance of agriculture in the economy and notes that priorities for agricultural development "should entail a concerted and intensive effort to achieve a drastic reduction in the food import bill." Furthermore, "opportunities for expanding nontraditional exports must also be pursued as a parallel initiative to be intensified over time." The twin desires to enhance food security through increased self-reliance and to generate foreign exchange through agricultural exports imply that the sector must diversify.

The sugar industry is the last remaining element from the export-oriented agricultural period, and its rationalization "is a central element of the thrust towards development of the agricultural sector. This rationalization must involve considerable emphasis on the diversification of production of lands which are now devoted to the cultivation of sugarcane." Diversification out of some traditional commodities is a priority because of their poor market performance; diversification into producing and processing other fruits, vegetables, and ornamentals is needed to satisfy local and foreign demands.

The National Agricultural Development Plan (National Planning Commission 1988) assesses production and market constraints for agricultural commodities and identifies "strategies for their development" in the country. National research priorities are to support

- increased domestic output of food and raw materials for agroprocessing;
- increased income and employment, as well as lower costs in agriculture and agroindustries;
- reduced imports of livestock feeds and other agricultural inputs;
- increased foreign earnings from agricultural commodities.

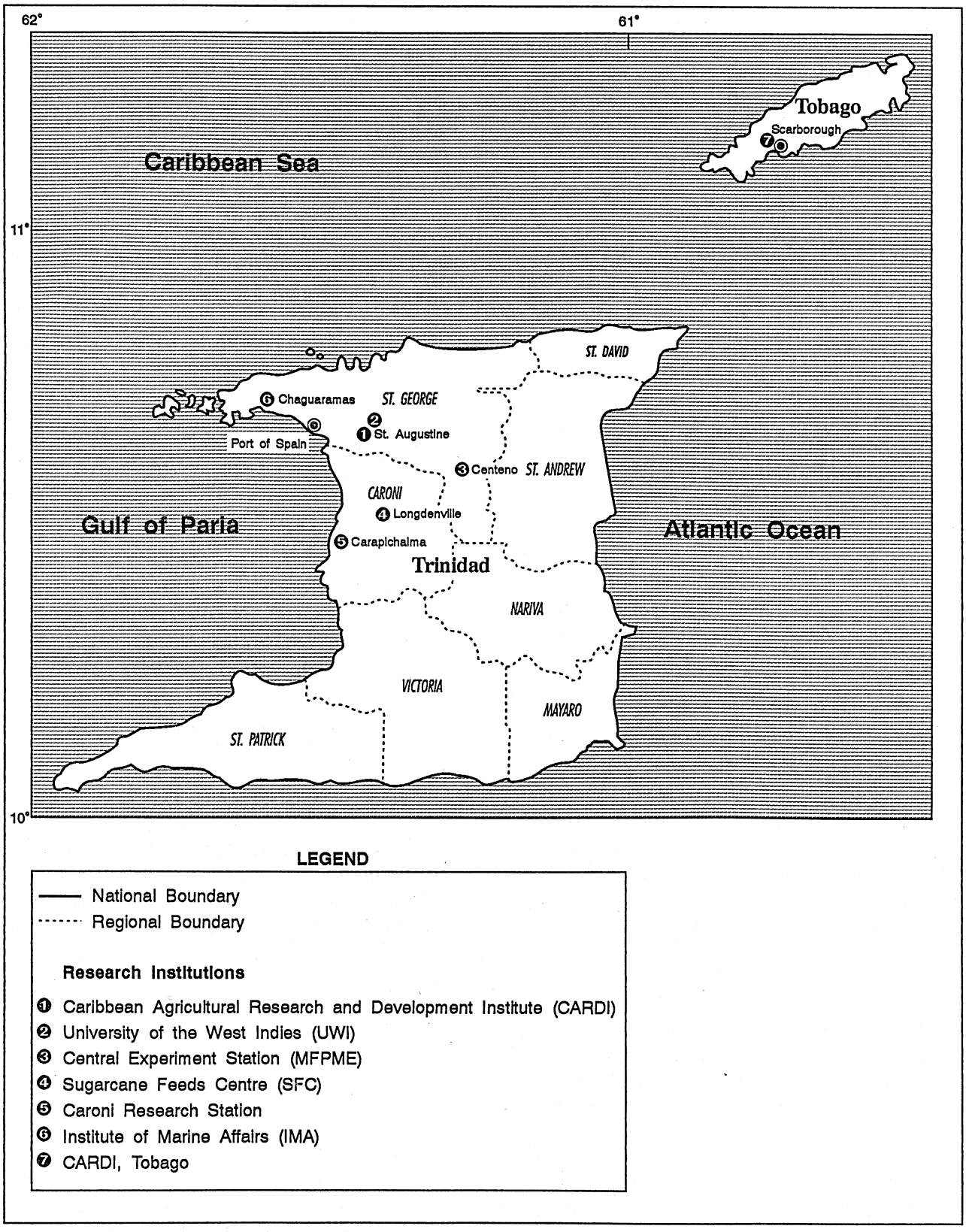


Figure 1. Location of research institutions in Trinidad and Tobago

Organization of Agricultural Research

Trinidad has a long tradition of high-quality agricultural research, dating from 1922 and the creation of the Imperial College of Tropical Agriculture (ICTA). Agricultural research today includes forestry, fisheries, and agroprocessing and is conducted by national institutions in the public sector, government-owned parastatal organizations, and some regional organizations located in the country. An overview of the institutions involved in research is given in table 1.

Public-sector research is concentrated in the Ministry of Food Production and Marine Exploitation (MFPME), mainly in its Research, Fisheries, and Animal Production and Health Divisions. Forestry research was recently moved to the Ministry of Environment and National Service.

Table 1. Organizations Involved in Agricultural Research

Organization	Status	Major Programs	Scientists	Information Staff[a]
Research Division	Ministry of Food Production	Crops Livestock	53	2
Sugarcane Feeds Centre (SFC)	Parastatal	Animal Nutrition Crops as Feed Livestock	7	0
Institute of Marine Affairs (IMA)	Parastatal	Fisheries Marine Biology Marine Pollution	30	5
Fisheries Division	Ministry of Food Production	Fisheries	11	1
Forestry Division	Ministry of Environment and National Service	Forestry	1	0
Caroni	Parastatal	Sugarcane Diversification Crops Livestock	10	0
Caribbean Ag. Res. & Dev. Institute (CARDI)	Regional Organization	Crops Livestock	2[b]	2[c]
University of the West Indies (UWI)[d]	Regional Organization	Crops Livestock Socioeconomics Agroprocessing	37	1.5
Veterinary Diag. Lab. (VDL)	Ministry of Food Production	Veterinary Science	2	0
Caribbbean Ind. Res. Inst. (CARIRI)[e]	Parastatal	Agroprocessing Food Science	43	0.5

a. Professional information staff.
b. CARDI scientists working on research in Trinidad and Tobago.
c. CARDI information staff provide services to the entire region.
d. University staff are involved in both teaching and research.
e. CARIRI staff work in other areas as well as agriculture.

Three parastatal organizations conduct agricultural research and receive support from the public sector. The Institute of Marine Affairs (IMA) was established in 1978. Its research is applied and adaptive and focuses on aquaculture, coral reef management, pollution, marine biology, sponges, and coastal zone management. This is supported by intensive data collection on stock assessment, beach profiles, and environmental impact assessment.

Caroni Research Station (CRS) is the research arm of Caroni Ltd., which manages sugar plantations that came under national ownership in the 1970s. Caroni is a government-owned parastatal organization, receiving its funds from the Ministry of Planning and Mobilization. The main difference between research at Caroni and elsewhere is the emphasis that Caroni gives to commodities that can be grown on a large scale, using mechanization and with commercial benefits to the company.

The Sugarcane Feeds Centre (SFC) receives some 60% of its funding from the Ministry of Food Production and the other 40% through sales of services and products. The center is not a research institute per se but is involved in technology transfer, demonstration and training, and research when appropriate.

The Caribbean Industrial Research Institute (CARIRI) is funded by the government of Trinidad and Tobago and provides technological research and industrial research to the private and public sectors in the CARICOM region.

Two regional organizations are headquartered in Trinidad. While they are not strictly part of the national system, much of their research work is carried out in Trinidad and elements of their programs must be considered as part of the local research effort.

The University of the West Indies (UWI) provides graduate education in agriculture up to the PhD level through its Faculties of Agriculture and Engineering and conducts some research. Also located on the university campus is the Caribbean Agricultural Research and Development Institute (CARDI). With a regional mandate, CARDI concentrates its research effort on other countries in the region, maintaining a small program in Trinidad and Tobago. In addition, Trinidad supports the research work of the West Indies Central Sugar Cane Breeding Station (WICSCBS) in Barbados.

A joint project of the ministry and the university that is international in scope is the Cocoa Research Unit (CRU), which maintains the International Cocoa Genebank, Trinidad (ICGT).

In the private sector there are some companies involved in new agricultural enterprises, especially in the potentially lucrative export market for specialized crops and ornamentals, such as orchids. They conduct no research, relying instead on the public sector and external sources for research resources and expertise.

Coordination of Research

The National Agricultural Development Plan (National Planning Commission 1988) identified "inadequate coordination of research programmes" as a major constraint to effective agricultural research in the country and recommended the establishment of an agricultural research committee to

- establish national agricultural research policy;

- determine research emphasis for each branch of agriculture in the country;
- approve, modify, and monitor individual research projects;
- monitor and evaluate implementation of national agricultural research policy.

As yet, this committee has not been constituted. An earlier proposal in 1977 to establish a coordinating council for research and development to consolidate some of the dispersed programs has yet to be implemented. Any restructuring of agricultural research will await the results of a current (May 1991) institutional study of the Ministry of Food Production by consultants from the Inter-American Development Bank (IDB).

The National Institute of Higher Education, Research, Science and Technology (NIHERST) was established in 1985 (Act No 20, 1985) under the Ministry of Planning and Development. It is intended to promote coordination among national technology centers, promote cooperation between national and foreign research and development institutions, and promote linkages between higher education and research. In agriculture, much of this has not been effected to date, though NIHERST does organize an annual agricultural research seminar at which all research bodies are expected to present updates on research in progress.

Programs and Scope of Research

The issues of information demand in this study are based on discussions with research managers and from current research work plans and documents. In addition to this more subjective and qualitative information, data about current agricultural research projects collected by the Current Agricultural Research Information System (CARIS) center in Trinidad in 1986 and 1989/90 is used to draw a broad picture of commodity emphasis both nationally and by institution.

Overview

Data collected in 1986 and 1989/90 by the regional CARIS center in Trinidad and Tobago provide an overall picture of the research program and illustrate some recent changes in focus.

Figure 2 shows the systemwide distribution of projects by CARIS subject category in 1986 and 1989/90. Projects in plant production and protection dominate the scene, and they continue to increase in number. Apart from postharvest research, projects in other disciplines are few. Table 2 illustrates the distribution of the same projects between institutes. Unfortunately, for 1989/90 the CARIS database has no information for CARDI or the SFC, so the picture is incomplete.

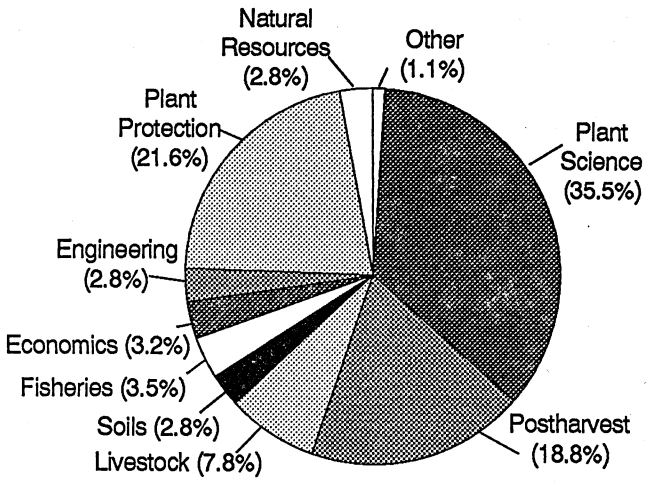
A more detailed assessment of research efforts by commodity is presented in table 3. This is a frequency breakdown of current research projects according to the crop or animal being researched. Numbers of projects alone are not sufficient to measure the system's scope since they do not indicate the scale of resources and time dimensions involved in each project. The assumption for this study, however, is that higher numbers of projects generally represent greater effort and resources allocated to the commodity in question. Rice is the most researched crop, followed by sugar cane, coffee, cocoa, cassava, and passion fruit.

Another way of assessing the breadth or scope of research in Trinidad and Tobago is to group and discuss research activities according to the categories identified by Eyzaguirre (1991) and shown in table 4.

Table 2. Distribution of Research Projects by CARIS Subject Category

CARIS Subject Category	MFPME		Caroni		UWI		CARIRI		CARDI		SFC		IMA	
	1986	1989 -90	1986	1989 -90	1986	1989 -90	1986	1989 -90	1986	1989 -90	1986	1989 -90	1986	1989 -90
Plant Science and Production	39.2%	55.9%	34.6%	40.7%	14.7%	26.5%	26.0%	13.6%	73.1%		25.0%			
• Agronomy	(27.2%)	(38.7%)	(27.0%)	(32.4%)	(2.9%)	(6.1%)	(11.0%)		(34.6%)		(25.0%)			
• Genetics & Breeding	(10.4%)	(14.0%)	(3.8%)	(0.9%)		(7.2%)		(4.5%)	(38.5%)					
• Physiology & Taxonomy	(1.6%)	(3.2%)	(3.8%)	(7.4%)	(11.8%)	(13.2%)	(15.0%)	(9.1%)	(15.0%)					
Plant Protection	27.2%	25.8%	48.1%	43.5%	5.9%	14.3%								
Postharvest	15.2%	8.6%		1.9%	47%	24.5%	63.0%	68.2%	3.8%					
Livestock	8.0%	5.4%		0.9%	5.9%	1.0%			15.4%		50.0%			
Soils		2.2%	13.5%	2.8%	2.9%	3,1%								
Fisheries	2.4%					5.1%							100%	66.7%
Economics	1.6%	1.1%			8.9%	6.1%		9.1%	7.7%		16.7%			
Engineering	0.8%			7.4%	8.9%	6.1%	11.0%	9.1%			8.3%			
Natural Resources	5.6%			1.9%	2.9%	6.1%								33.3%
Other		1.1%	3.8%	0.9%	2.9%	7.1%								
Number of Projects	124	93	52	108	34	98	27	22	26	N/A	12	N/A	7	3

Source: UWI (1989); CARIS database for the Caribbean.



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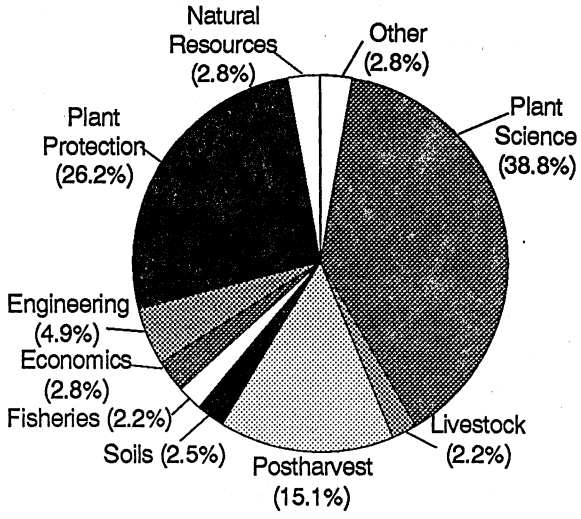

1990

Source: UWI (1989); CARIS database for the Caribbean.

Figure 2. Research projects by CARIS subject category

Global Staples

Rice is the most important commodity in this group, with 31 current projects in the country. Approximately 80% of the rice consumed in Trinidad is imported, and the national priority is to increase both the total area under rice and crop yields through improved seed and agronomic practices. The research division of the MFPME has two researchers working on varietal screening, testing, and seed production (for both research and commercial purposes). The emphasis is moving away from agronomy towards postharvest and processing issues.

At Caroni, irrigated rice is researched by the CRS, and large-scale preproduction testing of rainfed rice is in progress. Three students from the university are collaborating with Caroni staff on rice research. Again, the emphasis is on varietal testing for local application.

Table 3. Distribution of Research Projects in CARIS by Major Focus, 1989-90

Commodity	Number of Projects	Commodity	Number of Projects
Rice	31	Mangoes	6
Sugarcane	17	Maize	6
Coffee	14	Pineapples	4
Cocoa	11	Peanuts	3
Cassava	10	Coconuts	3
Passion fruit	10	Cowpeas	3
Feed crops	9	Sweet potatoes	3
Pigeon peas	7	Guavas	3
Citrus	6		

Source: UWI (1989); CARIS database for the Caribbean.

Soybeans and maize are also tested on a large scale by Caroni; in the case of soybeans, this is without much research by the CRS. At the university's Faculty of Agriculture, two students are doing research on maize in collaboration with Caroni staff, using Caroni facilities. A maize project is in progress in Tobago funded by CARDI.

The ministry, the university, and Caroni have all done research on potatoes and cassava. Potatoes have not been a success, and in most places the research has been discontinued. Cassava research in the ministry's Research Division is now receiving less emphasis in favor of sweet potatoes. At Caroni, cassava research will probably be discontinued because of the small local market for fresh cassava and the lack of processing facilities.

Traditional Export Crops

Sugar research is carried out by Caroni. National priorities for the crop are to reduce its production to satisfy local needs only. Caroni is therefore diversifying into other commercial crops for export and local consumption. Even with diversification, Caroni still manages large sugar estates of about 35,000 acres and continues some adaptive research with one full-time researcher.

The company does no breeding or upstream research, relying on the West Indies Breeding Station to send them varieties for testing and adaptation. A new joint project with the International Institute of Biological Control (IIBC), NIHERST, and UWI is looking at measures to control the sugarcane froghopper and reduce the company's expenditure on costly chemical pesticides.

Cocoa was an important crop for Trinidad until the 1960s when changing economic and political conditions combined to reduce its importance. Production and research output declined, and only relatively recently have they increased in response to the improved market for cocoa products and changing sectorial priorities. Applied and adaptive research on cocoa is conducted jointly by UWI and the ministry, and it concentrates on agronomy, disease management, and genetic resources. The genebank is recognized by the International Board for Plant Genetic Resources as a global center for cocoa germplasm, and 'Trinidad' varieties are distributed around the world to other research centers.

Bananas have not been a priority for research in recent years. The search for niche export markets for local varieties is generating some demand for research to assess their characteristics and potential for improvement.

Table 4. Categories of Research Domains

Global Staples	Traditional Export Crops	Minor Food Crops	High-Input, Nontraditional Export Crops	Livestock	Socioeconomics and Rural Engineering	Natural Resource Management
Beans	Bananas	Apples	Asparagus	**Small Ruminants:**	Farm Management	**Fisheries**
Cassava	Cashewnuts	Barley	Broccoli	Goats	Farm Structures	
Cowpeas	Cinnamon	Breadfruit	Brussels Sprouts	Sheep	Farming Systems Research	**Forestry**
Groundnuts	Cloves	Broad and Mung Beans	Cardamom		Marketing research	Agroforestry
Maize	Cocoa	Cabbage	Citrus	**Large Animals:**	Postharvest and Storage	Genetic resources
Potatoes	Coconuts	Carrots	Flowers/ Ornamentals	Cattle	Machinery and Tools	Plant pest and disease management
Pulses	Coffee	Castor Beans	Fruits	Horses	Irrigation	
Rice	Cotton	Date Palms	Ginger	Camels	Rural Engineering	**Land Use and Water Mgmt**
Sorghum	Oil Palm	Figs	Grapes	Donkeys	Agroprocessing	Soil (fertility, erosion, conservation)
Soya	Rubber	Fruit (local use)	Grapefruit		Agroindustries	Water resource management
Wheat	Sisal	Garlic	High-Value Vegetables	**Small Stock:**	Agricultural Wastes	Range and pasture
	Sugar	Lentils	Jojoba	Chickens		
	Tea	Melons	Kava	Ducks		
	Tobacco	Millet (*Eleusine, Digitaria*)	Litchis	Turkeys		
		Mustard (seed)	Mangoes	Swine		
		Nectarines	Papayas			
		Oats	Passion Fruit	Animal Health		
		Okra	Peaches	Feeds and Nutrition		
		Onions	Pineapples	Animal Breeding		
		Pandanus	Plums	Wildlife Management		
		Peas (garden-)	Pyrethrum			
		Pears	Quinquina	**Aquaculture**		
		Peppers	Ramie (textile fiber)			
		Pigeon peas	Sour Sop			
		Plantain	Strawberries			
		Radishes	Sunflowers			
		Safflower (oilseed)	Vanilla			
		Sesame	Ylang-ylang			
		Sunflowers				
		Sweet Potatoes				
		Swiss Chard				
		Taro (*Xanthosoma, Colocasia*)				
		Tomatoes				
		Triticale				
		Turnips				
		Vegetables (local use)				
		Yams (*Dioscorea*)				

Source: Eyzaguirre (1991).

Priorities for the coconut industry are diversification and reduced operating costs. In the past, red-ring disease was a research priority; however, research in the ministry's Research Division is now greatly reduced. The national priority for coffee is self-sufficiency in the supply of beans for local processing. Caroni grows some coffee, doing adaptive research on problems faced by their managers.

Minor Food Crops

Most of these crops are grown in Trinidad to satisfy local food needs and also with an eye on possible export markets. In general, research priorities for vegetables and root crops are postharvest handling, pest and disease control, and selection and improvement of varieties for processing and fresh consumption. Sweet potatoes are the main emphasis in the root-crop program at the ministry; yams also receive some attention. Pigeon peas, black-eyed peas, and kidney beans are the main thrusts for grain legumes.

Pigeon peas are being tested on a large scale at Caroni to investigate their commercial suitability; in this case, the research staff were also involved in small-scale trials. CARDI supports some pigeon pea research in Tobago. Citrus research in the ministry receives less attention than it did in the past. This is because the fruit agronomist left the ministry, and the person responsible for citrus research had to assume responsibility for the entire fruit research program.

Nontraditional Export Crops

National agricultural policy gives a high priority to increasing the production of export crops. Production of traditional crops like cocoa is being revived under this approach. However, the major changes in the sector are in the growth of investments by entrepreneurs, commercial enterprises, and farmers in high-value fruits, vegetables, and ornamentals for export. For instance, the West Indian Tobacco Company (WITCO) recently invested some TT$ 250,000 (US$ 62,000) in orchid production as a replacement for tobacco. These producers need information in order to diversify successfully, but they conduct and sponsor little research.

Within the ministry, the research program includes projects on passion fruit, carambola, anthuriums, orchids, ginger, and heliconias. Technological packages for some crops have already been developed through the IICA regional fruit production project and in association with the French government; however, the Research Division will continue to identify, screen, and test new cultivars (Howard 1991). Caroni's program on passion fruit will probably be reduced because of the large effort needed to achieve sufficiently high yields and the major disease problems encountered. University personnel are involved in several research projects, including some on peppers and orchids.

Most of these varieties are imported from abroad — anthuriums from the Netherlands and orchids from Thailand, for example. Although their basic agronomy is known, researchers in Trinidad are convinced that substantial national research on local production and disease problems. Much of this research is focused on postharvest storage, packaging, and handling to enhance the shelf life or resistance to damage during transport. The ministry is particularly active in these areas of research, trying to "satisfy the everchanging tastes of the consumer" (National Planning Commission 1988: 35).

Livestock

Animal breeding and evaluation of local feedstuffs to replace imported feeds are the two research priorities identified in the agricultural development plan for all types of livestock. Most livestock research is conducted within the MFPME, either in its divisions or at the Sugarcane Feeds Centre. CARDI does some research on sheep and goats in Tobago. Most UWI

research is conducted jointly with ministry staff.

The SFC gives greatest emphasis to production systems involving livestock, crops, feeds, and by-products of animal and crop processing. The research is adaptive in nature and focused on small producers and enterprises. Feed and nutrition studies on sheep, goats, and cattle are important at present; pigs will become more important when the piggery under construction is complete.

The Livestock Research Sub-Division in the Ministry of Food Production does breeding, health, and nutrition work on cattle, sheep, goats, and pigs. A shortage of animals, however, severely restricts the program. Animal health, veterinary science, and diagnostic services for livestock are provided by the Veterinary Diagnostic Laboratory (VDL).

The agricultural development plan identifies research on local feeds for poultry as a priority, but the only research carried out in the country is disease surveillance and testing by the VDL. This is because the poultry industry is structured around assembly-type facilities in which all the necessary equipment, facilities, and eggs are imported from outside the country. Any research is done abroad, and poultry farmers have no need for location-specific research. This may change as poultry flocks are developed locally.

Socioeconomics and Engineering

Most socioeconomic research is conducted at the University of the West Indies in its Departments of Agricultural Extension and Agricultural Economics.

Postharvest and agroprocessing research are conducted by the university's Department of Chemical Engineering and at CARIRI. Figure 2 shows that 15% of current research projects registered in the CARIS database for Trinidad are in these disciplines. Fully 68% of CARIRI and almost 25% of UWI projects (mostly in the Department of Chemical Engineering) are on postharvest problems. Shortages of land available for fieldwork at the university probably contribute to this situation — laboratory-based research is more practicable. In addition to the properties and processing of agricultural commodities, the university's program includes projects on sugar technology. There seems to be some collaboration with Caroni but not with the CRS, which concentrates on agricultural production technologies.

Natural Resource Management

Research on forage and pastures is conducted in the MFPME. This is almost entirely screening and testing of varieties obtained outside the country. Breeding grasses, for instance, is considered to be particularly difficult, requiring special skills and facilities, and research managers are willing to rely on international research centers to do this work.

Pests, diseases, and weeds of crops are a major focus of research in Trinidad and Tobago. Separating the efforts assigned to research from diagnostic and advisory work in these areas is very difficult. During 1989-90, over 25% of current research projects were focused on plant protection (figure 2). In the ministry's research division, 11 of the 41 scientists in crop research work on plant pathology or entomology (table 5) and about 25% of research projects are in this area.

At Caroni, plant protection is the main focus of research, accounting for nearly 45% of their projects. This reflects the company's need for diagnostic support and experimentation to solve problems in the field. Plant breeding and genetics do not really feature in Trinidad's research program except in cocoa.

Fisheries research is conducted by the Institute of Marine Affairs (IMA) and the Fisheries Division of the MFPME. Re-

Table 5. Ministry of Food Production and Marine Exploitation, Research Division — Research Staff Allocation to Commodities, May 1991

	BSc	MSc	PhD	Total
Crop Subdivision				
Rice	1	1	—	2
Root Crops	2	—	—	2
Fruit	2	0.5	—	2.5
Citrus	1	0.5	—	1.5
Ornamentals	1	—	—	1
Cocoa	1	—	—	1
Coffee	2[a]	1	—	3
Vegetables	—	2	—	2
Seed Testing	—	1	—	1
Biometrics	—	1	—	1
Postharvest	1	1	—	2
Soil Chemistry	—	3	—	3
Tissue Culture	1	—	—	1
Entomology	1	3	—	4
Plant Pathology	3	3	1	7
Coconuts	1	—	1	2
Bananas	1	—	—	1
Plant Quarantine	2	—	—	2
Total Crops	20	17	2	39
Livestock Subdivision				
Forage\Pastures	1	1	1	3
Animal Breeding	—	2	—	2
Animal Nutrition	—	1.5	—	1.5
Mgmt\Disease Unit	3	—	—	3
Total Livestock	4	4.5	1	9.5
Administration	1	2.5	1	4.5

* One person on study leave.

search in marine fisheries concentrates on stock assessment, marine pollution, environmental impact assessment, and coral reef ecology. The Fisheries Division and IMA collaborate with Venezuela in a joint program that focuses on stock assessment, monitoring, and management. Some aquaculture research on freshwater tilapia, marine cascadura, giant prawns, and pompano is in progress at IMA. The adaptation, testing, and transfer of tilapia research to farmers is mostly done by the Sugarcane Feeds Centre.

Soil research is primarily conducted in relation to a specific crop, and these projects are mostly located in the university, MFPME, and Caroni. There is almost no forestry research in the country.

Summary

This section grouped research programs by categories according to the way in which research is conducted globally and information about it is likely to flow. It demonstrates the system's emphasis on crop research and the importance to research of nontraditional crops for local processing and consumption, as well as export. Livestock, fisheries, forestry, socioeconomic, and natural resource re-

search receive much less attention. The only areas of research that rival crops in importance are food science and agroprocessing, which in fact are mostly concerned with crops. Table 6 summarizes the distribution of efforts among institutions for the different commodities researched in the system.

Applied research is centered in CARIRI and the university, and it strongly emphasizes agroprocessing, postharvest problems, and socioeconomics. Other applied work in crop production is in progress at the ministry, (mainly cocoa), UWI, CARDI, and the IMA. All other research is adaptive or testing.

For some commodities, the analysis of scope showed a division of research efforts among institutes. It is most striking in the areas of agroprocessing, food science, and postharvest research where the University of the West Indies and CARIRI dominate. The Sugarcane Feeds Centre and the Ministry of Food Production do most of the relatively small amount of research on livestock, and that done on fisheries is conducted by the Institute of Marine Affairs. Research on sugar production is centered on Caroni, with research on sugar technology carried out in the university. Cocoa is a joint effort between the ministry and the university.

In contrast, the growing research focus on fruit, vegetables, and ornamentals, mostly for export, is spread across the system. This probably reflects the national urge to cash in on high-value crops, forcing researchers throughout the system to respond to the industry's needs. The ministry and the university are most active in the area — the peculiar nature of Caroni's research and the emphasis on large-scale production have so far given them little success with nontraditional crops.

Management of Scientific Information

Three main aspects of information flow and management can be expected to have a significant influence on the way information is accessed and managed in small countries. These are the *demand* for information from research, the potential *sources* of needed information, and the *mechanisms* that managers use to identify and acquire it. This approach and the concepts upon which it is based are discussed in more detail by Ballantyne (1991).

Demand for Research Information

Managers of research respond to demands for information from their staff by providing information services and by facilitating scientists' contacts with one another. This section assesses the demand for agricultural research information in Trinidad and Tobago and discusses some factors associated with the research system itself that influence the shape and nature of the demand.

Table 6. Institutional Focus by Research Commodity

	Research Division	Caroni	UWI	CARDI	CARIRI	VDL	Forestry Division	Fisheries Division	IMA	SFC
Rice	+++	+++								
Root Crops	+++	+	+							
Fruit	++	+	+	+						
Citrus	+	+	+							
Cocoa	+++		++							
Coffee	++	+								
Ornamentals	+++	++	+							
Sugar Cane		++								
Plantains & Bananas	+	+	+							
Pigeon Peas	+	++	+							
Peanuts				+						
Maize		+								
Soybeans		++								
Vegetables	+									
Postharvest Crop Problems	++		+	+	++					
Food Science			+		++					
Plant Protection	+++	+	+							
Coconuts	+									
Fish								+	+++	+
Forestry							+			
Livestock Health			+			+				
Livestock Nutrition	+		+			+				++
Livestock Breeding	+	+		+						
Pastures	++	++								
Livestock Products										+
Poultry						+				
Pigs	+									
Sheep & Goats	+		+	+						+
Dairy Cattle	+	+	+							
Beef Cattle										+
Socioeconomics			++							

Scope of Research

The most important determinant of demand for information in Trinidad and Tobago is the content of the research program. The most important change in scope over the last few years has been the trend towards diversification. For a number of reasons, and often with government encouragement, farmers are growing new crops for local and export markets. After independence, the research system changed its emphasis from export crops to food crops and is now once again moving towards a program more focused on export crops.

Successful research and development of these nontraditional export crops, like ornamentals and fruit, needs basic agronomic data, as well as information about commercial production techniques, local economic and market factors, postharvest storage, shipping and handling, important licensing or patent restrictions, quarantine and quality standards, and market trends and prospects. Much of this information is outside the traditional information channels and sources used by researchers in Trinidad, and appropriate strategies for identifying and acquiring this information are needed.

Researchers' Location

The greatest demands for information are likely to remain in the Ministry of Food Production where most researchers and projects are located. The university has many researchers, mainly students, whose needs are often channelled through the projects in which they work. Researchers at Caroni and SFC, while few in number relative to the ministry, need to screen and assess a wide range of sources in order to select the crops or technologies that suit their purposes. They will need access to perhaps more information than their small numbers suggest but only information that is targeted to their precise research interests.

Adaptive Research

The emphasis on technology adaptation and testing in the national research program means that scientists must identify and select technologies from a wide range of different sources. There is a demand from scientists for information that allows them to keep up with the research and the literature of a subject enabling them to *source* useful technologies. This requires access to a broad range of information sources as well as specific sources for each commodity.

The Multidimensional Role of Research

The overall scarcity of human resources in agricultural R&D means that research personnel engage not only in research activities but also in diagnostic and advisory services to extension and farmers, commercial seed producers, policy advisors to the ministry, and trainers. Information demands are therefore not limited to current research interests or, indeed, to research problems.

Staff Mobility

In addition to their multiple roles, researchers in Trinidad and Tobago frequently move between and across research programs, often changing the focus of their research in the process. There are few staff members allocated to each commodity or group of commodities at any one time, and these movements of staff often result in one or another commodity no longer receiving full-time research attention.

In the public sector, this mobility is associated with promotion patterns that make it difficult to be promoted while retaining the same commodity focus. How to maintain continuity of support to a commodity, even if the research is no longer being done, and ensuring that staff who move into "new" crops have access to the information sources associated with their new

responsibilities are key issues that information services must resolve. Sometimes, as in the case of potato research described below, the researcher may need to learn a new crop from the basics upwards. Information support for these researchers is not always concerned with specialized higher-level information; it may also include more basic agronomic or botanical information.

Changes in Research Programs

In small countries, research on a new crop usually means that an existing program of work will stop and information support to both the new and the old commodities needs to be evaluated. The effects of these programmatic changes are most marked when they occur with little or no warning to information personnel. Two recent cases in Trinidad highlight the problems for an information unit.

A research program to assess the suitability of foreign varieties of potatoes was launched in response to demands for research on potatoes to replace imports. Most other vegetable research at the ministry was stopped, and staff were reallocated to potato research. They found that potatoes could be grown with large investments in time and inputs, and substantial research would be needed to sort out the disease and soil problems encountered. Subsequently the research was discontinued.

This sudden change in emphasis from vegetables to potatoes had a number of effects on information demand. First, it was a new crop and the researchers involved knew very little about it. They needed basic information about the crop and about its cultivation in conditions similar to Trinidad and Tobago. Second, there was almost no information available in-country other than some reports of small-scale trials in the distant past, and the information unit was not linked to potato information networks. The library's response was to contact the International Potato Center (CIP) in Peru for information and to purchase substantial amounts of documentary information. The subsequent changes mean that this is now hardly used.

A more recent case involves bananas. Traditionally Trinidad and Tobago do almost no banana research, relying instead on the Windward Islands Banana Growers Federation (WINBAN) in Saint Lucia for information. There is also a tacit agreement that Trinidad will not compete with the small Windward Islands to produce bananas for export. But recently there have been demands within Trinidad to improve the industry and to invest resources in research. The ministry's response was to set up a Banana Advisory Committee to investigate the situation.

The committee recommended that Trinidad and Tobago conduct some banana research, but only on local varieties with export potential that are not exported by the other islands and which will therefore not be in competition. The ministry's library does not currently purchase banana information and has very limited capacity to support a banana research program. Recently, however, the librarian attended a meeting to create a regional banana information network for the Caribbean, linked to the International Network for the Improvement of Banana and Plantain (INIBAP), which may provide access to the needed information.

These cases demonstrate how changing research priorities, often with very short notice, have an impact on the information function. In the case of potatoes, the library is left with expensive information, useful for only a short time, that is no longer used. In the case of bananas, the library must begin to actively identify and obtain new sources of information, at some cost in personnel, materials, and possibly loss of service to other programs.

For bananas, the librarian's position on the management committee of the MFPME

helps ensure that information personnel will become aware, informally at least, of new developments. In both cases however, no new resources have been provided to the information unit to service these new needs. Similarly, no resources were provided to ensure that information staff were trained or made aware of the new priorities and the new sources of information that needed to be tapped.

Ensuring that changing priorities are communicated to the information unit or service is essential, and specific mechanisms to do this are required. In addition, making sure that the information unit can respond to new priorities, either by increasing resources or authorizing cuts in other areas, is critical.

Mechanisms to Acquire Information

In this section, the mechanisms that are used in Trinidad and Tobago to access scientific information are described and discussed in relation to the research system and its demands for information. Mechanisms discussed include libraries and information centers, information networks, research networks, and personal contacts.

Libraries and Information Centers

The MFPME network is coordinated and managed by the librarian of the research division in Centeno. Libraries are dispersed through the ministry, receiving central management support and training. Funding is through specific allocations from the divisions involved. The network presently operates libraries in the research division, the planning division, the Eastern Caribbean Institute of Agriculture and Forestry (ECIAF), the fisheries division, the animal production and health division, and the Agricultural Teacher Education Centre.

Small countries, with their resource limitations, often maintain one information service to serve a variety of user groups and functions. This is in contrast to large countries where separate information units serve each group and subgroup in the agricultural sector. This is a significant, and complicating, factor in Trinidad where the multiple roles, functions, and clientele served by the library of the research division create some tensions and sometimes stretches the service beyond its capacity.

The existing information strategy aims to create a network of information centers serving each part of the ministry as well as the agricultural community at large. The research division is the Ministry of Food Production's main library and it primarily serves the research arm. It is also expected to provide information services to a broad agricultural community, which includes farmers, students, extension workers, academics, and the private sector, as well as acting as Trinidad's national agricultural library.

Although there are now several libraries in the network, many nonresearch users depend on the research library for their information, indicating that the overall strategy is not fully implemented at this time. If resources were available to the network, active information centers in different parts of the ministry and outside could be developed to focus on their specific groups of users, allowing the research library to focus on the particular needs of researchers.

At Caroni, diversification into new products has stimulated them to investigate other innovative mechanisms for acquiring the information that they need. In-

stead of developing an in-house information capacity, they make use of other information services and research personnel in the country. In addition, Caroni maximizes the use of external expertise through short consultancies by experts in particular fields, often from abroad.

The director of the Sugarcane Feeds Centre has recognized the need for his staff to have access to an organized information resource and in the past recruited and trained a person to organize and run their small library. Unfortunately, this person resigned and the center is once again seeking a suitable employee. In the meantime, information is rather disorganized and difficult to access.

The Information Division of the IMA includes a library with one professional librarian. In addition, the division has two professionals engaged in data collection on environmental issues as well as public awareness and educational activities. A systems manager and director of information fill the remaining two information positions. The IMA and the Fisheries Division library have established collaborative journal-acquisition and contents-page services and have discussed joint participation in the Aquatic Sciences and Fisheries Information System (ASFIS). Both centers use ASFIS methodologies but agreement has not yet been reached on the nomination of a national focal point for fisheries information.

The Caribbean Industrial Research Institute (CARIRI) has a technical information service for its in-house research and development activities and provides technology information and intelligence to external clients for a fee. In agriculture, these services are in the areas of agroindustry and agricultural machinery development.

The University of the West Indies maintains a library to support the research and teaching activities of its students and staff. It contains the excellent collection of the former Imperial College of Tropical Agriculture (ICTA) and probably has the best collection in the country, and perhaps the region, on the former export commodities — sugar, cocoa, and bananas. CARDI uses the resources of the UWI and MFPME libraries to a large extent to provide information support to its member countries. It is also developing a specialized collection that reflects its own research interests.

Information Networks

Libraries in the Ministry of Food Production benefit from information obtained through information networks and also make use of tools and approaches developed by networks to organize nationally generated data. Requirements that libraries in Trinidad collect and process national literature for input to a network has motivated them to invest resources in collecting local and regional information, most of which is nonconventional, location-specific, and highly relevant to the country. At present, contributions to the networks are spin-off benefits from the regular collection of information and data to satisfy local needs.

The research division library is a contributor to the CARISPLAN system for socioeconomic information coordinated by the UN Economic and Social Commission for Latin America and the Caribbean. This is the first of several regional information systems to be developed in the Caribbean, and it has technical specifications for inputting data that differ from AGRIS, the FAO system also in wide use. Agreement to participate in CARISPLAN preceded AGRIS and this now creates difficulties for the library, which must process the same materials for the two systems. Development of a conversion format that allows easy interchange of data between the different systems should be a high priority for the national center.

An invitation for Trinidad and Tobago to

participate in a Caribbean and Latin American subregional information system on bananas and plantains is under discussion in the ministry. If approved, it will provide access to banana literature produced in the region and, through INIBAP's global network, to information from other continents.

Collaboration among Information Centers

CARDI, UWI, and the ministry collaborate in collection building and development, document delivery, training, and other related information activities. An informal committee of the librarians concerned oversees the process and makes sure that problems are solved. While each information center has its own clientele and priority themes, informal collaboration between information staff has been a success story so far, opening the information resources of all participating centers to the staff of each center.

Problems are likely to concern the informality of the arrangements and the dependence on personal contacts and agreement for their implementation. Only at UWI are there sufficient professional information staff to provide back-up support to the individual involved in the committee. At both CARDI and the ministry, these activities rely on one person and only form part of that person's wider responsibilities. The importance of these linkages needs to be emphasized and incorporated into job descriptions for any additional information staff in the various institutions.

Coordinating and formalizing this collaboration to create a national research information system for agriculture would give research managers a tool to ensure that their research programs are adequately supported with information, even in areas in which their own information unit is weak.

Outside of the three main centers, the lack of functioning information centers at Caroni and the SFC exclude them from these national efforts. The problem is that the information and materials available in these centers, or generated by them, are difficult to access from other institutes in the country. Measures are needed to bring them into the national system. The problem for research managers and information specialists alike is to decide how realistic it is for each component of the system to have its own information unit.

Whether or not the SFC, Caroni, and other similar institutions need their own formal information centers, they do need access to information. Joint assessments by staff of MFPME and other centers are necessary to further identify their information needs and possible delivery mechanisms. These would investigate options, including areas of cooperation where information is exchanged and both sides benefit.

Collaboration with regional institutes like CARDI and UWI provide Trinidad and Tobago with information that is not easily accessed by most small countries. Access to these resources, as well as to international sources, is essential if the country is to make best use of the technologies and information generated elsewhere.

CARDI and the Ministry of Food Production are in contact with the information components of the international agricultural research centers (IARCs). This involves access to IARC information resources, but future collaboration may include possibilities for study or training for information staff. A valuable mechanism for acquiring information is the Technical Centre for Agricultural and Rural Cooperation (CTA), based in the Netherlands. CTA maintains a regional office for the Caribbean at CARDI that disseminates information to the region and acts as a device for countries to articulate their needs to CTA.

Membership in the International Association of Information Specialists is another

mechanism used to develop and maintain contacts with other information centers around the world. Similarly, the librarian of IMA participates in the activities of the International Association of Marine Science Libraries and Information Centers.

Research Networks

Research networks are used in Trinidad and Tobago to obtain information, new varieties, and training. The benefits of network participation are recognized by researchers and their managers; there is also a healthy questioning of their usefulness by researchers. In most cases, network collaborators are individual researchers and the information obtained from the networks may be personalized to such an extent that it is not widely shared. The view that this participation could perhaps be institutionalized and the information better disseminated within the system is gaining support, although direct action to improve this situation remains to be initiated.

The most active network is the Caribbean Rice Improvement Network (CRIN) located in the Dominican Republic. Researchers in the ministry and at Caroni have access to international resources such as Centro Internacional de Agricultura Tropical (CIAT) and the International Rice Research Institute (IRRI) through the network. CRIN provides its collaborators with a regular newsletter, opportunities for short courses and study tours, regular workshops, funds for small collaborative projects, and access to documents produced by international research centers. Researchers also value the regular visits from the network coordinator, who provides technical advice and assistance. The Caribbean Animal and Plant Health Information Network (CARAPHIN) is particularly useful for its information about the animal and health situation in the region.

In livestock, there is little active participation in networks. There were contacts with CIAT pasture and fodder crop networks in the past, but when the national researcher concerned changed responsibilities, these contacts were lost and have yet to be reestablished by the present researcher. Information from networks outside the region, in South Asia for example, is not considered to be so useful. At the SFC, staff are aware of the RISPAL network coordinated by IICA, but its communications are in Spanish, which is a barrier to participation. In the future, researchers expect to be actively involved in an FAO-sponsored regional network on small ruminants which is to be revived.

In general, there is less participation in research networks than expected. Reasons for this include staff turnover and changes in Trinidad, inactivity of some networks, and the Hispanic orientation of many networks in Central and South America. Passive participation by the research system in many networks is indicated by the large numbers of network publications that reach the various libraries. This information, when organized, is more accessible to the system as a whole, but it is probably not being fully utilized.

Personal Contacts

In Trinidad and Tobago, the main mechanism for obtaining information is personal contact between scientists and personal contact between information specialists. This is true both for in-country communication, where all the researchers seem to know one another, and for information from abroad.

For information from abroad, researchers cite personal contacts at research centers and universities as important sources for their research. Usually, these contacts are made during visits, study tours, and meetings of one sort or another. Researchers at Caroni make particular use of their contacts, frequently using telecommunications and information technology to forward requests for information directly to people they know.

Their parastatal status is a factor that enables them greater freedom of movement and travel outside the country, and several instances of information and technology being acquired directly from external research centers through visits to individuals were cited.

Although personal contacts are used together with more formal libraries and information centers, it is notable that their greatest use is where traditional library and information services are least active — at Caroni, at the SFC, and in the livestock subdivision of MFPME.

Research Seminars

The Ministry of Food Production began a Research Seminar Series in 1983. Initially associated with the ministry library, it is an effort to ensure that research work is disseminated and documented. The series, now fortnightly, continues to be a valuable source of local data and an important forum for researchers to present their work.

Information Technology

Information technology developments in the research system include on-line access to computerized databases through international telecommunications, local access to databases through CD-ROM, and the introduction of electronic mail. On-line access to databases through hosts like DIALOG is expensive, but CD-ROM technology provides low-cost access to major agricultural databases from local nodes.

The CTA project on "Introduction of CD-ROM Technology to Developing Countries" is having growing benefits for information access. The project has provided hardware and training, as well as subscriptions to the AGRICOLA, CAB Abstracts, and TROPAG databases on CD-ROM. Participation in the AGRIS network ensures that AGRIS discs are also received, and links with CIRAD in France have made their SESAME database available in the library.

The combination of hardware, software, training, and a document-delivery support service in the CTA project enables the libraries involved (MFPME, UWI, CARDI) to provide levels of service that were not possible before. The sustainability of services in the medium and long term, after donor funding and interest shifts, is a big issue. Local resources to maintain and improve these computerized services will have to be found.

The use of electronic mail systems to access local and regional centers is being explored through a project (funded by the International Development Research Centre [IDRC]) that includes the libraries of MFPME, CARDI, and UWI. This technology has great potential for linking scientists as well as libraries, and technical developments in scientists' access to computers and network usefulness will need to be monitored.

Summary

Libraries, information centers, research seminars, and information networks are the only mechanisms in which the system has consciously invested. Patterns of use, support, and effectiveness vary between programs and institutions and result from institutional priorities, variability in demand, availability of alternative mechanisms, and probably, politics. Personal contacts between researchers are the most frequently used mechanism and probably the least "managed" and understood. Research networks are the least-used mechanism, at least in any systematic way.

Information Sources and Flows

Knowledge and information flows for individual commodities or research domains vary, and the use and effectiveness of each mechanism for getting access to information differs between crops and domains. Choosing the appropriate blend of mechanisms and approaches is a critical component of information delivery in Trinidad and Tobago and must take account of existing information sources and flows for each commodity being researched.

The categorization of technologies developed by Eyzaguirre (1991) and illustrated in table 4 is a useful framework for assessing these flows and will be used for the following discussion. He suggests that commodities can be grouped according to the way in which research is conducted on them globally and that these groupings influence the flows of information for a specific crop. Thus, crops like rice, maize, and cassava fall into a group of "global staples," each of which is a major focus of international, publicly funded research efforts. Although the crops themselves are very different, patterns of information dissemination are similar. The producers of this information use widely available journals and publications as well as research and information networks to disseminate their results. The differences between groups of crops can be illustrated by an example from Trinidad and Tobago.

A researcher explained that information about a staple crop such as cassava is much easier to locate and obtain than information on eddoes, another locally important root crop. This, he suggested, is due to the presence of CIAT in Colombia, which conducts research on cassava. Research at CIAT is supported and knowledge disseminated through a number of research and information networks based at the center. The library of MFPME is also in close contact with CIAT and can obtain information with little difficulty.

The opposite situation is true for eddoes (*Colocasia* spp.). Little work on this crop is done at international centers, and there are no networks to link researchers and disseminate information. The International Root Crops Society meetings contain some information, but this reflects the interests most researchers have in potatoes, sweet potatoes, and cassava. If little research is being done on eddoes, and what is being done is spread across a number of institutions, it will be difficult to locate the information. Extra efforts and new approaches or mechanisms for finding and obtaining this information may be needed.

This section describes the different sources and suppliers of scientific information that are currently used by the research system in Trinidad and Tobago and discusses their role in relation to the system's demands for information.

Global Staples

Rice, soybeans, maize, potatoes, and cassava are all supported by international agricultural research efforts, and information is accessible from traditional information sources such as books, journals, reports, conference papers, and bulletins, as well as research and information networks.

CRIN is important to both MFPME and Caroni for rice. Until recently, there was a Japanese expert in the research division who brought knowledge and information about Asian production techniques into the system. Soybeans, maize, and potatoes receive the most research attention from Caroni, which obtains information from resources in-country or gets short-term expertise from abroad.

Major sources of information about cassava are CIAT in Colombia, the International Root Crops Society, the University

of Florida, and Wye College, although these contacts are often with individuals and not institutions. Although CARDI has information about root crops in general, not much of it is relevant to research in Trinidad and Tobago.

Traditional Export Crops

Outside Trinidad and Tobago, most of this research is conducted by the private sector or in countries that have large export-oriented investments in the crops. Information about coffee and cocoa for example is concentrated in countries such as Brazil, Kenya, and Ghana. Trinidad and Tobago is a member of the International Cocoa Organization, the Cocoa Producers' Alliance, and the International Coffee Organization. The country is represented through its embassy to the United Kingdom who send information back to Trinidad at sporadic intervals. This information is mainly related to the coffee or cocoa markets, but it could be very useful for research planning and priority setting. Improved coordination at interministerial levels would make this information more accessible to the research system.

The university library has an enviable collection of information on cocoa dating back to the ICTA period, when cocoa was both a major export crop and a research focus. Current cocoa materials are also well represented. In the Ministry of Food Production, the library concentrates on cocoa pests and diseases and tissue culture, reflecting current research priorities. Coffee was not a major export crop in Trinidad and Tobago, and there is minimal information support, either retrospective or current, for it.

Research on sugar and bananas relies on regional institutions like WICSCBS and WINBAN. Sugar is declining in importance and information on it is concentrated at Caroni and UWI. Information on bananas has mirrored research and received little attention in the recent past. New research initiatives to support bananas for export will require greater investments by the MFPME library; recent contacts with INIBAP and regional banana information centers will certainly be valuable sources of further information. Only in cocoa has the country developed a substantial upstream research capacity, and information for this research is concentrated in the university and the MFPME libraries.

Minor Food Crops

Some crops considered minor on the global level are important in the food economy of Trinidad and Tobago; however, relatively little information about them is available from the international centers or networks. Only for yams and sweet potatoes can information staff draw upon IITA and CIP, respectively. Otherwise the information is scattered and quite difficult to access. Personal contacts between scientists may be more effective than traditional library channels for these crops.

Nontraditional Export Crops

Ornamentals, fruits, and vegetables with high export potential are important subjects of research in the system. Unlike information on a staple like rice, information about these commodities and their production is increasingly available only from private companies and countries that compete with Trinidad for the same markets. This information is difficult and costly to identify and locate, and often expensive to obtain.

Existing scientific information services have difficulty getting this information, and so far, most information has come from personal contacts between scientists or between local producers and foreign growers. This seems to work well but suffers from the main problem of personal contacts — they are links between individuals, and information obtained this way is often not documented, shared, or made available to the national information system for future reference and utilization.

New approaches involving several actors in the industry are needed to provide systematic and effective access to this information. One approach is for MFPME to capitalize on private-sector interests, sharing the costs involved in getting this information. For example, small commercial growers recently formed a floriculture association to promote their interests and explore joint marketing arrangements.

It would be expensive for the association to launch a major information effort on its own, duplicating some efforts of the ministry and other information services in the country. However, if there is interest and some coordination, it would be possible to acquire specialized information to serve the needs of ministry researchers as well as members of the group. Costs could be shared between the parties to their mutual benefit. Such an approach is being used by the Horticulture Society, which work with the librarian of the Ministry of Food Production to organize their information resources.

Livestock

There are few sources for livestock information in the international centers. At the International Laboratory for Research on Animal Diseases (ILRAD), the research work on trypanosomiasis, for example, may not be relevant to Trinidad. The International Livestock Centre for Africa (ILCA) concentrates its information dissemination efforts on African countries and is reluctant to provide major support to other countries.

Information in ministry libraries to support livestock research is minimal. This is due partly to the relatively small amount of livestock research in the system, but also to the location of researchers away from the main research complex. Livestock research personnel are not situated close to the library; they use the information less and have less of a role in developing the collection to match their interests. There has been a demand from these researchers for library materials and resources for livestock to be moved closer to them.

Personal contacts are the predominant mechanism used by livestock researchers for acquiring information. On the positive side, this information — obtained during study visits or from other people — is usually more relevant, current, and credible than information obtained from other sources. However, the heavy reliance on these personal contacts may be a signal that other mechanisms are not working. Poor support from libraries as well as the low level of participation in livestock research networks have already been noted. There seems to be some justification for information staff to reassess services to the livestock research subsector, paying more attention to the information received in the system through the networks of personal contacts between researchers.

Socioeconomics and Engineering

Socioeconomic data about trade, prices, and marketing may be required to support economic research on export commodities. Research that adapts and tests technologies for local conditions requires access to social science data and analyses, especially about locations where the technologies will be used. This kind of research is typically stronger in universities and centers that emphasize technology transfer and advice. Special efforts will be needed to identify and bring this often "fugitive" information into the system.

This type of information is often available outside the agricultural research system and access through normal agricultural databases and sources is limited. Some of these data are available through databases such as CARISPLAN for general socioeconomic information and CARTIS for trade data. A system for agricultural marketing data (CAMIS) has been proposed but is not yet in operation. Access to FAO statistical data will be greatly facilitated by the recent nomination of the

MFPME library to be the local correspondent for FAO's World Agricultural Information Centre (WAICENT).

Agroeconomic data from outside the country is also necessary, in particular information such as market trends and projections, prices, packaging, shipping, and quarantine regulations. Access to these kinds of information through the Ministry of Food Production's libraries is limited and could be improved by formal agreements with other organizations like the Export Development Corporation, which has better access to these data.

Natural Resource Management

Natural resource information is spread across many organizations. The UWI library supports a teaching program that includes biology, botany, zoology, and several areas of geography and social geography.

Information for fisheries research is accessible through the libraries of the Fisheries Division (which recently absorbed the collection of the Caribbean Fisheries Training and Development Institute) and IMA. There are strong links and collaborative mechanisms for sharing information between the two libraries. An IDRC project for a fisheries management information system has resulted in several databases, including a bibliographic database on fisheries material relevant to the country.

Information on forestry is the mandate of the Forestry Division of the Ministry of the Environment and National Service. The collection of information is strong for retrospective materials, less so for current information. Recent efforts to develop an environmental information system will probably lead to more emphasis on information about environment and forest management, and linkages between these subjects and agriculture need to be defined early in the process.

Information on soils is particularly strong at UWI, dating from the ICTA period when soils were a major research focus of the Regional Research Centre. UWI continues to be involved in soil research through its Department of Soil Science in the Faculty of Agriculture, and it maintains substantial information support in its library. In the Ministry of Food Production, soil research is more limited and is generally in the context of a specific crop. Resources in the library are limited mainly to a few journals, although further collection building in this area is in progress.

Issues and Lessons from Trinidad and Tobago

The past strength of Trinidad and Tobago's economy and the support still derived from the petroleum sector has allowed the country to acquire much of the information infrastructure (telecommunications, computers) that it needs. But this is not always available to the research system, which has evolved over almost 70 years and has substantial resources of knowledge, both in people and documentation. National investments in information systems for agriculture are relatively recent, but the basis for a national system to access scientific information is in place: issues have less to do with creating an information function than with strengthening, reorienting, and in some areas, broadening existing services.

Changing Demand for Information

More than in larger countries, agricultural research programs in Trinidad and Tobago are in a state of almost perpetual change. Each year new commodities are added and others fall out. Research staff move between them according to need, which requires different approaches to both managing and acquiring information. Management issues relate to ensuring that information specialists are informed about program changes and receive appropriate financial support for them. The main issue of acquisition is to reorient library and information services to keep up with the changes, becoming more aware of potential sources of information.

Managers of research must determine how information can best be organized to support the changing focus and diversification from crops like sugar to new products such as maize, coffee, or livestock. Has the use of locally available information (through libraries and personnel) and external expertise (consultants) been more effective than developing an in-house information capacity? And can it be a model for other centers?

Multiple Functions of Information Services

The research division library provides information services to a broad agricultural community, acts as a national agricultural library with repository and archival functions, and has some publishing and editing responsibilities. Is this the most appropriate way to serve the research community? Perhaps an information service dedicated to research is necessary, but if so, the various nonresearch functions should be reallocated elsewhere in the system. Alternatively, the ministry can allocate more resources to the research library to enable it to provide better information for its varied clientele.

Closer Contacts with Research

Research priorities determine what research is conducted in the system and the information that it therefore must access. Information is an input to the products of planning (research programs), and it also contributes to the priority-setting process itself. Once decisions have been made, mechanisms to ensure that information services know about proposed changes are essential, and guidance on reallocating information resources among programs may be necessary.

At present, information staff rely on personal contacts and attendance at staff meetings to stay abreast of changes in priorities and programs. Formal information assessments do not seem to be part of any research priority-setting process. Mechanisms for integrating the information function into research planning and priority-setting are needed, and managers and scientists should be aware of the implications of their decisions for information services.

Management Support for Information

One strongly positive factor present in Trinidad and Tobago has been the high degree of support for information development among both research managers and managers in the ministry, which has been strongest in the research division where the ministry's library is located.

It is difficult to provide reasons for the strength of this support in certain places, while in other institutes it is notably less obvious. Perhaps the information service in the research division has proved itself to be especially useful, or the library manager is a good lobbyist, able to convince decision makers of the value of the services. Whatever the reasons, very little could have been achieved by the information service without this support.

Visibility

The MFPME librarian has managerial status, which allows information issues to be raised at senior levels in the ministry. It also gives the information service a chance to learn about program changes and to participate in planning and policy-making.

This visibility is a characteristic that is more likely to be found in small countries, and it permits lobbying for the library at the highest level. In the current financial year, management was persuaded to increase the library's budget by 100%

The Private Sector

Private-sector issues relate to both the private sector's role as generator and source of information, as well as its role as a client of information services in the country. There are many restrictions on access to the information that it generates, related to both cost and competition. As clients however, local companies are so far not paying for the information that they receive from public-sector information services.

How does the system best gain access to the information generated by the private sector, particularly for ornamentals, fruits, fertilizers and pesticides, and certain areas of biotechnology and agroprocessing? Mechanisms are needed to ensure that restricted and often costly information about promising private-sector technologies can be identified, obtained, and if necessary, paid for. Otherwise, this information will not be available to producers in Trinidad.

At the same time, some attention should be paid to possibilities for collaboration and joint funding of information provided to the private sector by public information services or for fee-based services from the Ministry of Food Production to these clients. Some categorization of clients according to their ability to pay for services will have to be developed.

National Collaboration and Coordination

Without a coordinated research system in the country, information collaboration has arisen from informal discussions between information staff and is not institutionalized. Coordination of research is already on the national agenda; it should be a high priority for research managers to link better information coordination (as opposed to collaboration, which already exists) with efforts to coordinate research.

It is essential that steps be taken to bring research centers like the SFC and Caroni into the information network. A joint approach to the problem is necessary to ensure that specialized services suit their needs and strengthen the national system for information sharing.

Regional and International Collaboration

If research is to maintain its window on world knowledge, it is essential that information services be outward-looking, working with scientists to scan and locate relevant information. Information staff from Trinidad and Tobago are involved in many regional initiatives for information sharing and access, as well as international projects such as AGRIS, CARIS, and the information work of the CGIAR system. These contacts keep information staff up to date with potential information sources and new ideas, strengthening and improving the flow of information into Trinidad's research system.

Maintaining this participation in regional and international discussions by attending appropriate meetings and following up on opportunities for closer contacts with appropriate centers will continue to provide benefits to the national system. There is also a strong case to be made for maintaining these contacts so that Trinidad's problems and needs are brought to the attention of donors such as CTA or information producers such as the international centers.

Networks

Participation in research networks is rather haphazard, depending largely on the interests and priorities of individual researchers. Research managers need to identify and evaluate potentially useful networks and then manage participation so that maximum benefits are obtained for the system. Local mechanisms to ensure that network products and information are disseminated and used within the research system could be investigated, perhaps as part of the effort to coordinate research and information.

Information networks are a special case because the participant is usually the library. In these cases attention is needed to ensure that network demands for information from Trinidad and Tobago do not overwhelm the system they are intended to support. Participation in international information systems needs to be assessed in relation to benefits vis-a-vis the priorities and responsibilities of national and regional systems. There is also the need for policies by a coordinated information group on participation in these systems.

Information Technology

The information explosion has been accompanied by dramatic developments in information technology. More and more databases exist that might be useful, and methods for providing access to them is a preoccupation of many information specialists and researchers. The main issue is to ensure that essential information in these databases can be made available to researchers in Trinidad and Tobago. This entails getting access to information and making it available within the system.

The research division library has capitalized on its opportunities to be a global test site for various donor projects with CD-ROM and electronic mail and has benefitted substantially in the process. These opportunities should be actively pursued as ways to obtain low-cost access to global information. Participation in these donor projects in the future probably depends on the degree to which the information unit can maintain its extrovert viewpoint, as outlined above.

Information Personnel

Ensuring that skilled staff are available to perform the necessary information tasks is a critical issue. The appropriate numbers, distribution, skill mix, and strength in depth of staff working in agricultural information are not known.

If the information service in Trinidad and Tobago is to play a more central role in research, one that involves more and closer work alongside researchers to scan and screen information, then it needs to reconsider the skills of its professional staff. Knowledge of agriculture is essential, both to provide useful services and to gain credibility and acceptance from research staff. Knowledge of information management is needed to provide tools and approaches to access and manage data. The research division library has a professional librarian as well as an agricultural graduate with a BSc in agriculture. Each has one of the qualifications required, and together they provide the necessary skill mix. Apart from the regional organizations, only IMA and CARIRI have trained information staff serving their researchers.

The relative investment in information activities in small countries is higher than that in large countries. Whether this investment is in information professionals or in scientist time allocated to information scanning and synthesis is debatable.

There is a ratio of about one information professional for every 10 scientists at present (table 1). It is difficult to determine an appropriate ratio since each center is different, and the skills required from information staff depend on the kinds of services that are needed. It is an issue that can only be resolved after the demand for information is clearly defined and the service levels required by research managers are identified.

One problem the system may face is a shortage of skilled information staff in agriculture and agricultural research. Over the past 10 years, the network of libraries and information units in MFPME has grown under the influence of one professional librarian. It now depends on this person for leadership and management, and there are very few experienced professionals available in the system to take over if the position were to become vacant. It is a major question mark hanging over the information system's medium- and long-term sustainability.

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