PN-ABF-086
66058

Report to the Government of Kenya

ISNAR R24

# KENYA AGRICULTURAL RESEARCH STRATEGY AND PLAN

Volume 1:
Organization and structure

isnar
International Service for National Agricultural Research

The International Service for National Agricultural Research (ISNAR) began operating at its headquarters in The Hague, Netherlands on September 1, 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 to strengthen their agricultural research. It is a non-profit autonomous agency, international in character, and non-political in management, staffing, and operations.

Of the 13 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 organization, planning, manpower development, staff requirements, financial and infrastructure requirements, and related matters, thus complementing the activities of other assistance agencies. ISNAR also has active training and communications programs that cooperate with national agricultural research programs in developing countries.

ISNAR also plays an active role in assisting these national programs to establish links with both the international agricultural research centers and donors.

ISNAR is supported by a number of the members of CGIAR, an informal group of approximately 30 donors; it includes countries, development banks, international organizations, and foundations. In 1986, funding for ISNAR's core program was provided by:

Australia
Belgium
Canada
European Economic Community
Federal Republic of Germany
Ford Foundation
France
Ireland
Italy
Netherlands
Philippines
Spain
Sweden
Switzerland
United Kingdom
United States Agency for International Development
World Bank

Citation:

International Service for National Agricultural Research. Kenya Agricultural Research Strategy and Plan. Volume 1: Organization and Structure. 1985. The Hague, Netherlands.

PN-ABF086

ISNAR R24

Report to the Government of Kenya

# KENYA AGRICULTURAL RESEARCH STRATEGY AND PLAN

Volume 1:
Organization and structure

December 1985

isnar

International Service for National Agricultural Research

## Contents


| | |
|---|---|
| | List of Acronyms |
| | Executive Summary |
| CHAPTER 1 | General Introduction |
| CHAPTER 2 | Agricultural Research Priorities and Programs |
| CHAPTER 3 | Manpower Development and Training |
| CHAPTER 4 | Rationalization of the Network of Research Stations and Institutions |
| CHAPTER 5 | Organization and Coordination of Research Programs |
| CHAPTER 6 | Research Support Services and Research Center Development |
| CHAPTER 7 | Funding of Agricultural Research |
| CHAPTER 8 | Research/Extension Linkages |
| CHAPTER 9 | Reorganization of KARI |


Annexes


| | |
|---|---|
| ANNEX I | Map - Major crop production zones of Kenya |
| ANNEX II | Map - Major soils and agro-climatic zones of Kenya |
| ANNEX III | Map - Recommended agricultural research centers and districts of Kenya (District focus) |
| ANNEX IV | Mandates of National and Regional Research Centers |
| ANNEX V | Classification of Research Support Services |
| ANNEX VI | Suggested Model for Strengthening Research/Extension Linkages |
| ANNEX VII | Extract from the Scheme of Service for Research Posts in Kenya |
| ANNEX VIII | Identified Projects for Strengthening Kenya's National Agricultural Research System |

## LIST OF ACRONYMS

| | |
|---|---|
| ACIAR | Australian Center for International Agricultural Research |
| ADC | Agricultural Development Corporation |
| AERLC | Agricultural Extension/Research Liaison and Communication |
| AIC | Agricultural Information Center |
| AVRDC | Asian Vegetable Research and Development Center |
| BAT | British American Tobacco Company |
| CGIAR | Consultative Group on International Agricultural Research |
| CIAT | Centro Internacional de Agricultura Tropical |
| CIMMYT | Centro Internacional de Mejoramiento de Maiz y Trigo |
| CIP | Centro Internacional de la Papa |
| CRF | Coffee Research Foundation |
| EAAFRO | East African Agriculture and Forestry Research Organization |
| EAVRO | East African Veterinary Research Organization |
| ES | Experimental Sites |
| FRIK | Forestry Research Institute of Kenya |
| FTC | Farmers Training Center |
| GOK | Government of Kenya |
| IARC | International Agricultural Research Center |
| ICIPE | International Centre of Insect Physiology and Ecology |
| ICRISAT | International Crops Research Institute for the Semi-arid Tropics |
| IDS | Institute of Development Studies, University of Nairobi |
| IFPRI | International Food Policy Research Institute |
| IIMI | International Irrigation Management Institute |
| IITA | International Institute of Tropical Agriculture |
| ILCA | International Livestock Centre for Africa |
| ILRAD | International Laboratory for Research on Animal Diseases |
| IRRI | International Rice Research Institute |
| ISNAR | International Service for National Agricultural Research |
| KARI | Kenya Agricultural Research Institute |
| KFA | Kenya Farmers Association |
| KGGCU | Kenya Grain Growers' Cooperative Union |
| KREMV | Kenya Rangeland Ecological Monitoring Unit |
| MOALD | Ministry of Agriculture and Livestock Development |
| NAL | National Agricultural Laboratories |
| NARS | National Agricultural Research System |
| NIDRC | National Irrigation and Drainage Research Center |
| NCST | National Council for Science and Technology |
| NRC | National Research Center |
| PAREAC | Provincial Agricultural Research and Extension Advisory Committee |
| RRC | Regional Research Center |

# EXECUTIVE SUMMARY

## A. Background and Procedure

The purpose of this study, undertaken at the request of Kenya's Ministry of Agriculture and Livestock Development (MOALD) as a follow-up on an earlier ISNAR mission (1981), was to review the organization, management, and programs of agricultural research in Kenya, and to prepare a comprehensive medium-term national research strategy and plan. Specifically, the study, as required by the Terms of Reference, has focused on a review of Kenya's agricultural research programs and priorities, the rationalization of the network of research stations and institutions, and the identification of areas of infrastructural support necessary for the implementation of an improved national research strategy and program. The purpose, thus, has been to give a new sense of direction to research so as to improve its capacity to respond to accelerated programs of agricultural development.

Kenya's agricultural research programs and priorities have evolved and developed mainly along the lines of its pre-independence orientation. The planners and policy makers in Kenya now feel that the country's agricultural research policy should be more closely related to the economic needs of modern Kenya, should address the problems of the emerging class of small farmers, and should help to meet the challenges of population, nutrition, and poverty through improved agricultural productivity, programs, and policies.

The study was carried out by a team of two ISNAR senior staff and 10 consultants covering the various fields of research planning, organization and management, crop improvement and protection, horticulture, socio-economics and farming systems, dryland farming, soil/water management, animal production, veterinary research, research station development, agribusiness and research/extension linkages. The team was in the field in Kenya from September 10 to October 22 (1st phase) and from October 23 to November 14, 1984 (2nd phase), visited most of the research stations and institutions, and had intensive discussions with senior scientists and administrators in the Kenya Government, as well as with donors assisting Kenya's agricultural research system. The draft of the report was reviewed with senior research scientists and administrators of MOALD in February/March 1985, and many of the comments and suggestions from this review have been incorporated into this final version. Volume I presents the analytical framework for the strategy and plan and the major conclusions and recommendations for the reorganization of the national research system. Volume II presents detailed program areas, analyses, research priorities, and some implementation strategies and plans for new initiatives; it is provided essentially as reference material for research directors, program leaders, and other senior scientists. Volume I is directed primarily to policymakers.

## B. Conclusions and Recommendations

1. Agricultural research in Kenya has played a significant role in the economy and agricultural industry of Kenya. Achievements in the introduction, adaptation, application, and generation of improved technologies supported an impressive growth in the food, export-crops, and livestock sectors in the late 60s and early 70s. Unfortunately, it has not been possible to build on these gains. With a high population growth rate, increasing pressure on land, and

increasing demands for food and raw materials, it has become increasingly difficult for agriculture to meet the needs of Kenyans. Agricultural research faces new challenges that can only be met by well-organized, sharply focused research programs addressing priority problems and increasing farmers' productivity within a sound policy framework. This calls for a more effective deployment and utilization of present research resources and additional inputs for the rehabilitation, stabilization, and improvement of research infrastructure, organization, management, and institutions. All of these are prerequisites for the projected growth rate of 4.5 percent per annum in the country's agriculture.

The analysis and strategy which we present in this report help to define research priorities and programs clearly; to train and deploy manpower appropriately; to rationalize research centers' activities and mandates; to effectively coordinate research programs; to provide for improved research support services and research centers' development; to achieve adequacy and stability in funding; to strengthen research extension linkages; and to reorganize research by integrating KARI, Muguga, with the Scientific Research Division (SRD) of MOALD to constitute a new Kenya Agricultural Research Institute, semi-autonomous in its functioning, but closely related and responsive to MOALD.

2. Research priorities and programs have been proposed in relation to the priority needs of Kenya for food and raw materials for the manufacturing industries; export crops for foreign exchange; employment generation; and natural resources productivity and security. Emphasis is given to problems whose solution would make the greatest impact on production and agricultural growth.

3. Priorities in crops research focus on the major food crops - maize, wheat, rice, sorghum and millets, and on pulses, oilseeds, root crops, and fruits and vegetables. Research efforts in major food grains, with maize as the foremost, should focus on crop improvement, adaptability to various agro-ecological and production zones, crop management for improved productivity, and improved field and store protection. High-yielding, nutrient-responsive and pest- and disease-resistant varieties, adapted to the production zones and systems, should provide the strategy for increased productivity and improved nutrition. Pulses are accorded high priority in relation to their role in balanced nutrition and in soil improvement, oilseeds for food and import substitution, and fruits and vegetables for food and export earnings. Concerted research efforts on these crops are required in improvement and improved systems productivity and quality. High priority is assigned to the consolidation of present research efforts and the development of a long-term perspective for research and development needs in the two major export crops, coffee and tea. Industry-supported research is recommended for sugar and pyrethrum.

4. Soil/water management is accorded the highest priority, only equivalent to that of maize as a crop, as the most important factor influencing agricultural production in Kenya. This research should provide a strategy for increasing productivity and environmental security in the high- and medium-potential areas, and for extending productive agriculture to the more marginal semi-arid to arid areas.

A Dryland Farming Research Center (or Soil Water Management Research Center) at Katumani is recommended to provide a national focus for research in soil/water management, crop improvement for efficient water use, soil fertility, and related management research.

An Irrigation and Drainage Research Center at Ahero is recommended for a major focus on country-specific development of irrigation and drainage technologies to realize the irrigation and crop production potential of vast areas in the country and the development of drainage of unutilized, underutilized, and difficult soils in other parts.

Both the soil/water management and irrigation and drainage centers will have sub-centers and cooperating centers at the suitable locations indicated. All research efforts in crops and other factors of crop production would address more specifically the technology needs of small farms for improved productivity and stability of production in yield and quality.

5. Research programs in livestock accord the highest priority to animal production research in cattle for milk and beef. The next priority is to sheep and goats, followed by camels, with poultry and pigs having lower priority. Within animal production research, specific priorities are accorded to animal breeding, animal nutrition physiology, and management, and it is emphasized that these major areas are inter-related and require definitive focus in relation to the importance of the problems and with a thrust for improved efficiency and productivity. High priority is accorded to pasture and fodder research in both high and medium potential districts, while in the dryland farming areas emphasis should be on utilization and management of suitable grasses and legumes in natural pastures, and the propagation and utilization of legume browse plants and trees for livestock feed.

   Priorities in veterinary research should be largely determined by the nature of livestock production systems and the health constraints encountered. The priority focus should, therefore, be on the study of the health and production constraints operating in systems, disease epidemiology, economics, and means of improving the effectiveness of disease and parasite control methods. Emphasis should be on the development of technologies that will be robust and of practical value to the livestock producer. Some research related services, as in vaccine research and production and animal health control, deserve recognition and priority status but should be separately funded.

6. Farming systems research is accorded very high priority as the strategy for developing, adapting, and testing improved technologies in practical farming situations and with the participation of farmers, including the growing class of small farmers. A national Farming Systems Program operating from regional research centers (RRCs) and involving the cooperation of research, extension and farmers in technology testing and adaptation is recommended, and a framework for the national coordination of farming systems research is proposed. The strengthening of socio-economic research is proposed within the framework of the reorganized KARI.

7. Research Center Development. The mission has proposed a rationalization of the network of research stations and institutions (excluding the University) to create two main types of research centers of similar status: (a) National Research Centers (NRCs) to cover technology generation in first-priority crops, commodities, factors, and livestock; and (b) Regional Research Centers (RRCs) to take up adaptive and problem-solving research for regional problems of production systems (including livestock) through multidisciplinary and systems-oriented efforts. RRCs would have the major farming system research teams and provide for intensive interaction of research, extension, and the farmers; NRCs would have small on-farm research units cooperating with RRCs. RRCs are expected to serve broad agro-ecological zones and would have sub-centers where there is sufficient diversity within the zone to warrant such sub-centers.

   We propose a total of 13 NRCs and 6 RRCs, bringing the number of stations and substations down to 19 from the present 33. Sub-centers and experimental sites are only to be staffed by experienced technical officers and assistants. The needs of the research centers for functional facilities and support services in engineering (electrical, civil, mechanical, development, and management), administration, maintenance, etc., are considerable. Most centers would need major rehabilitation and strengthening of support services. A Research Support Services Division is recommended for the reorganized KARI and major capital and operational investment recommended for the National and Regional research centers. It is suggested that details of the rehabilitation and new infrastructure construction be worked out in the project preparation phase of this development.

8. Mandates. Following a review of the present diffuse mandates of stations and institutions and taking into consideration the proposed rationalization of the research network, we have defined the research mandates for each of the national and regional research centers. These mandates and the priorities should serve as the basis for the articulation of research programs for each of the centers. Some details are provided for centers which are new initiatives.

9. Coordinated Research Programs. We propose a national coordination of research for all crops, livestock systems and factors of first priority and national significance and importance. National coordination will feature a national 'coordination center' headed by a national project coordinator who would provide scientific leadership, supervise and review the organization and management of nationally coordinated projects, and organize training for junior scientists. Annual workshops would define responsibilities, collate research results, and generate recommendations on improved technologies for release to farmers. Other centers in key areas of production would serve as 'cooperating centers'.

   Initially, and until experience is gained, we recommend that national coordinated research projects be confined to the following: maize, rice, roots and tubers, food legumes, oilseeds, horticultural crops, animal breeding, animal physiology and nutrition, pasture and fodder improvement and management, soil water management, farming systems, and veterinary research.

10. Manpower Development and Training. Trained manpower at the level of scientists, technical officer/technician, and junior support staff is the most important constraint for agricultural research. Analyses show that only about 30 percent of the present scientific staff are adequately trained for research functions; technical personnel and junior support staff are also inadequately prepared. It is therefore proposed that the Government of Kenya should request assistance for a major manpower development and training project to upgrade both research and scientific research support staff in a phased program over the period of the next 10 years. The cost of manpower development and training required is provisionally estimated at $29.85 million over a 10-year period and would involve both overseas and local training for about 630 scientists and 300 technical support staff, as well as the strengthening of in-country postgraduate training at the University of Nairobi. Training in agricultural research management and the training of technicians and junior support personnel, some in appropriate international agricultural research centers, are recommended.

    The major investment in manpower development and training proposed would only be meaningful if such trained staff are properly deployed, motivated, made scientifically productive, adequately supported and rewarded, and provided with an overall improved research environment. The proposal to introduce a harmonized research productivity-oriented scheme of service as approved for the scientific staff in research institutes is endorsed.

11. Funding. Constraints of funding affect the research productivity of the trained research staff as well as the overall productivity of the system. Deficiencies in funding feature imbalance between personnel and operating costs, inadequacy of scale and scope of operations, distorted allocation of resources to programs, inadequacy of support of individual scientists, and instability of funding of programs and stations. It is recommended that GOK should provide or seek assistance to increase resources to the rationalized and reorganized research system so as to attain the level of 2% of AGDP in the next few years. Internal sources of agricultural industry-generated funds, e.g., cesses on some crops, seed, and livestock products, are suggested, but these must be supplemented by flexible external assistance and by policies which will enable the system to grow and be productive. It is stressed, however, that it is not the absolute shortage of funds, so much as the present budgeting and operational procedures which are responsible for most of the present difficulties.

12. Research/Extension Linkages. Research/extension linkages need strengthening at problem definition, technology design and testing, and technology adoption levels. We recommend that an Agricultural Extension Research Liaison and Communication Department integrating the Agricultural Information Center and the Agricultural Documentation Center be created within the reorganized KARI to provide an effective extension research communication and information service. The Assistant Director RRCs should have major responsibility for the organization and functioning of the service. RRCs should provide the focus for interaction and training of research and extension personnel and for on-farm research and demonstration activities essential for strengthening research/extension linkages.

13. Planning and Programming of Research. In order to institutionalize and strengthen planning, programming, monitoring, and evaluation of research within the Directorate of the reorganized KARI, it is recommended that Government should seek the assistance of an appropriate international research organization or agency for an advisor in this area for about 3 years. The function of the advisor would be to assist in the design of a system for the planning, programming, monitoring and evaluation of research activities and to be a principal advisor to the Director in the implementation of approved projects to strengthen Kenya's agricultural research.

14. Reorganization of KARI. The ISNAR team recognizes the value and continued validity of the concept of research organization embodied in the creation of a Kenya Agricultural Research Institute under the Science and Technology Act of 1979. We recommend that this concept should be fully implemented. This should be done by integrating the present KARI at Muguga with the Scientific Research Division (SRD) and creating in this way a reorganized KARI with its headquarters in MOALD, Nairobi. The new KARI, a semi-autonomous organization, will be fully committed to the agricultural development programs of MOALD and will act as its scientific wing, reporting for this purpose to the Board and the Minister of Agriculture and Livestock Development. We regard this action as an urgently needed reform for the agricultural research system in Kenya to function optimally and to implement our recommendations for the rationalization of the research centers' network and for the development and implementation of the research programs.

    We further recommend that the creation of the new KARI be achieved by ministerial action in accordance with the provisions of the Science and Technology Act (Chapter 250). The KARI Board is to be constituted largely of the major users of agricultural research, which means the Agriculture Department of MOALD, the farming community, the agricultural industry, and agricultural institutions. We have recommended a structure and organization for KARI consistent with these functions and responsibilities.

# CHAPTER I: GENERAL INTRODUCTION

## 1.0 Introduction

Agriculture plays a major role in the economy of modern Kenya, providing food, energy, incomes, and employment for the vast majority of its peoples, and raw materials for the growth and development of manufacturing industries.

Agricultural research has played a significant role in this achievement through the introduction, adaptation, application, and to some extent, generation of improved technologies. The changes since independence, the increasing population pressure on land, and the increasing demands for food and raw materials present new challenges to agricultural research. These challenges must be met with new research strategies if Kenya is to continue to provide improved food and nutrition for its rapidly increasing population and guarantee reasonable and orderly growth of the economy and stability for the society.

The agricultural research system has evolved and grown in size, complexity, and responsibilities since independence but has not been subject to in-depth review and reorganization necessary to address the specific problems and challenges of the modern era. In 1979, the Government of Kenya took a significant step in the reorganization of scientific research (including agricultural research) by promulgating the Science and Technology Act, Chap. 250. The creation of the Kenya Agricultural Research Institute (KARI) in that Act has not been fully implemented and has not achieved the necessary reorganization and improved effectiveness of agricultural research, in the spirit of the Act. Indeed, agricultural research organization, management, and infrastructure have deteriorated and may soon reach an all-time low that will make it difficult for research to meet the needs of the nation for agricultural growth and development.

In furtherance of the objective to strengthen Kenya's national agricultural research system, ISNAR was invited to undertake a review of the system in 1981. ISNAR, in reporting and recommending on the need to improve the system, recognized and drew the attention of the Government of Kenya to certain needs arising from a balanced analysis of the strengths, weaknesses, and constraints in the system. These included:

- the need to develop a more unified, comprehensive organization for the planning, promotion, and execution of research;

- the need for improved mechanisms for the determination of research priorities and allocation of resources;

- the need to strengthen communications and information flow within the system and between the system and other arms of government and non-government agencies;

- the need to strengthen mechanisms for the effective delivery of research results to the extension services and farmers (research/extension linkages);

- the need to increase the supply of well-trained and experienced manpower;
- the need to improve the research environment;
- the need to provide more socio-economic inputs into the definition and implementation of research programs and activities;
- the need to implement the small-farmer-oriented research strategy more determinedly.

The report was accepted by Government and as a result of a further request, a follow-up study by ISNAR in 1982 critically assessed the manpower training needs, and a 10-year plan for manpower development and training for the various levels of scientific and technical support staff in agricultural research was prepared. The urgency of the need for training remains as valid today as it was two years ago, and the present Mission, while updating the scale of training needed, has confirmed and further emphasized that need.

As Kenya enters the second half of the 80s with the pressing needs for increased agricultural production and productivity, the need for the reorganization of research has become extremely urgent. This document prepared by The International Service for National Agricultural Research (ISNAR) at the request of the Ministry of Agriculture and Livestock Development (MOALD) presents a plan for the reorganization, rationalization, and strengthening of agricultural research within the framework of a national agricultural research strategy, program and program priorities, and Kenya's development objectives.

## 1.1 Origin of the Mission

By the letter RES/1A of 17th February 1984, addressed by the Permanent Secretary, MOALD, to the Director General of ISNAR, the Government of Kenya requested ISNAR's assistance in the furtherance of the projects for organization and management of agricultural research, including the review of research priorities and programs, the rationalization of the research network, and the identification of infrastructural support for the implementation of the national research strategy and program. This request was a follow-up on ISNAR's earlier overall review of Kenya's NARS and the more detailed work on a Manpower and Training Plan for Kenya's Agricultural Research System undertaken by ISNAR in 1981-82.

After further consultations, ISNAR agreed to send a team of core staff and consultants to undertake the study for the preparation of a national agricultural research strategy and plan in September 1984. The Mission was undertaken in two parts, from September 10 to November 14 1984. The report was prepared at the headquarters of ISNAR in November and December 1984.

## 1.2 Terms of Reference

The following were agreed as the general objective and terms of reference of the Mission:

General Objective

To study the present organization, management, and programs of agricultural research in Kenya, and to prepare a comprehensive, medium-term, national research strategy and program.

General Terms of Reference

1. To review Kenya government research programs and priorities in the various sectors of agriculture and livestock development and prepare a coherent national agricultural and livestock research strategy and program.

2. To propose the rationalization of the present network of research institutions and stations and suggest the assignment of responsibilities in accordance with identified research needs and priorities and the national capacity for research.

3. To identify and quantify infrastructural support and other requirements necessary for the carrying out of the research functions and responsibilities envisaged in the national research stragegy and program.

In addition, specific terms of reference were prepared for the consultants in the areas of soil/water management, crops, agro-ecology and resources research, dryland farming, livestock, veterinary, horticulture, research/extension linkages, research station development, socio-economics and farming systems, and agribusiness.

1.3 Team Composition

The team was composed of:

| | |
|---|---|
| Prof. T. Ajibola Taylor, | Senior Research Officer, ISNAR.<br>Team Leader.<br>(Agricultural Research Planning, Organization and Management, and Crop and Animal Protection). |
| Dr. H.K. Jain, | Senior Research Fellow, ISNAR.<br>(Agricultural Research Planning, Organization and Management, and Crops Improvement). |
| Ir. J. de Graaff, | ISNAR Consultant.<br>(Socio-economics and Farming Systems). |
| Mr. H. Hobbs, | Senior Research Officer, ISNAR.<br>Consultant.<br>(Agribusiness). |

| | |
|---|---|
| Dr. D. Jha, | Research Fellow, IFPRI.<br>ISNAR Consultant.<br>(Socio-economics). |
| Dr. J.K. Leslie, | ISNAR Consultant.<br>(Dryland Farming). |
| Dr. E. Nunn, | ISNAR Consultant.<br>(Research Station Development). |
| Dr. W.J.A. Payne, | ISNAR Consultant.<br>(Livestock). |
| Dr. N.S. Randhawa | ISNAR Consultant.<br>(Soil/Water Management). |
| Dr. L. Tyler, | ISNAR Consultant.<br>(Veterinary Research). |
| Dr. E.W.M. Verheij, | ISNAR Consultant.<br>(Horticulture). |
| Ir. D. Zoebl, | ISNAR Consultant.<br>(Research/Extension Linkages). |

The Team was assisted by the following Kenyan team of counterpart agricultural research scientists:

| | |
|---|---|
| Mr. James B.W. Matata, | National Agricultural Laboratories |
| Mr. J.J. Adalla, | Ministry of Agriculture and Livestock Development |
| Mr. A.E.O. Chabeda, | Ministry of Agriculture and Livestock Development |
| Mr. S. Nganga, | National Agricultural Laboratories |

who accompanied the team on several field visits and discussions; and by many senior research scientists who freely discussed the problems, priorities, and programs of Kenya's NARS.

## CHAPTER 2: AGRICULTURAL RESEARCH PRIORITIES AND PROGRAMS

No agricultural research system, however large and well organized, can hope to solve all the problems affecting farm production in a country. The resources are usually not enough for this to be done within a reasonable time frame. For this and other reasons, the national research organization must evolve priorities by allocating human and material resources to those problems whose solutions would make the greatest impact on production and contribute to agricultural growth in other ways. This is particularly true in the case of Kenya, where the national goals of development have been clearly defined but the available resources are limited. The strategy for future development as laid down in the Fifth Development Plan (1984-1988) emphasizes growth and modernization without loss of feeling of kinship and concern for the welfare of others. It focuses on the critical question of improving the effectiveness of the organizational form in mobilizing resources for effective and equitable development, with specific concerns for utilization of productive capacity, promotion of external trade, promotion of efficient use of public and private sector resources, alleviation of poverty, and rural-urban and regional balance.

The specific objectives and strategy of agriculture and livestock are stated to include:

- increased food production;
- growth in agricultural employment;
- expansion of agricultural exports;
- resources conservation;
- poverty alleviation.

Agricultural production is targeted to grow at an average of 4.5 percent per annum, and per capita agricultural income is estimated to increase slightly faster than one percent per annum. Most of this increased production is expected to come from higher yields and improved production from the drier zones and grazing lands.

The policies and programs to be formulated within the framework of the plan are expected to emphasize:

- small-farm focus;
- more intensive resource use through improved crop and livestock husbandry practices;
- technology improvement (research and extension);
- market incentives;
- increased emphasis on arid and semi-arid lands;
- improved management and administrative procedures for efficient resource utilization.

Such emphasis will be reflected in the coordination of agricultural policy, institutional reforms and higher standards of management, improved pricing policies, improved marketing, improved land-use policies, and strong national research and extension programs.

The task of the agricultural research system is to translate these development goals policies and programs into relevant research priorities and programs. This exercise requires an analysis of the problems and factors affecting agricultural production and some of the most basic requirements of various commodities; their relative importance; the export and import projections; and above all, a consideration of the need to make Kenya's agriculture not only highly productive but also more stable and efficient in respect to the production processes. This latter consideration suggests that research should help to replace some of the non-renewable factors of production and promote the utilization and conservation of the basic resources (soils and water) of the country.

Research Priorities for Soil and Water Management

The most important factor affecting Kenya's agricultural production is its natural endowment of land and water resources. Few countries show such extreme agro-ecological differentiation as Kenya. Nearly 61.6% of the landmass is taken by the northern and northeastern pastoral lands (Annex I), which supports a small nomadic population and where no arable farming is possible. Of the remaining 38.4% of the land available for agriculture, more than half is taken up by semi-arid and arid zones, which in varying degrees suffer from serious moisture stress and, therefore, restrict crop growth and animal production. Table 2.1 shows the distribution of agricultural lands in the different agro-ecological zones, in the different provinces, and in relation to population density.

About 72% of Kenya's land is semi-arid and arid. The semi-arid and transitional zones (3 and 4) also suffer from moisture stress by virture of the fact that evaporative losses of moisture are high (Table 2.2).

It is not suprising that much of Kenya's more productive agriculture is confined to a limited area in the western and southwestern region, including the Western and Nyanza provinces.

The question we must ask is, can Kenya continue to have its productive agriculture confined to this narrow belt, with the arid and semi-arid regions making only a small contribution? The answer is clearly no, because the emerging population pressure will push more and more farmers into these less-productive lands. This has already begun to happen, and it can be anticipated that by the end of the century more farmers will be working in these other provinces.

Perhaps the most important research priority for Kenya lies in the field of soil and water management, and yet this is the area of research most neglected at present in the country. There is hardly any experiment station that has a significant program of research in this field. The existing programs are very feeble. Historically, it is understandable that Kenya, like many other developing countries in the 1960s, had to depend heavily on its more productive lands in order to increase food production over a short period of time, which was the main compulsion at that time. Kenya can still produce more food from its richer lands, but it is clear that time is now opportune to pay greater attention to the semi-arid and arid lands. It is for this reason that we propose elsewhere in this report the creation of a national research center for soil and water management at Katumani. Kenya must organize one of its most important research programs in the field of soil and water

Table 2.1: Categories of Agricultural Land and Population Density, by District

| | Total Land Area (sq.km) | Agricultural Land[1] Humid & Sub-humid (Zones I & II) | Semi-humid & Transitional (Zones III & IV) | Semi-arid & Arid (Zones V & VI) | Total Agricultural Land | % of Total Land | Population Density (1979) (sq. km) | Agricultural Land/Person (ha) |
|---|---|---|---|---|---|---|---|---|
| Western Province | 8,196 | 4,055 | 1,834 | 0 | 5,889 | 72 | 223 | 0.48 |
| Bungoma | 3,074 | 1,210 | 782 | - | 1,992 | 65 | 163 | 0.46 |
| Busia | 1,626 | 927 | 422 | - | 1,349 | 83 | 183 | 0.57 |
| Kakamega | 3,495 | 1,918 | 630 | - | 2,548 | 73 | 294 | 0.42 |
| Nyanza Province | 12,526 | 5,537 | 4,148 | 395 | 10,080 | 80 | 211 | 0.42 |
| Kisii | 2,196 | 1,914 | 11 | - | 1,925 | 88 | 395 | 0.26 |
| Kisumu | 2,093 | 605 | 992 | - | 1,597 | 76 | 230 | 0.48 |
| Siaya | 2,522 | 985 | 1,054 | 20 | 2,059 | 82 | 188 | 0.39 |
| S. Nyanza | 5,714 | 2,033 | 2,091 | 375 | 4,499 | 79 | 143 | 0.56 |
| Rift Valley | 163,884 | 9,115 | 14,725 | 26,363 | 50,203 | 31 | 19 | 3.68 |
| Baringo | 9,885 | 207 | 1,769 | 5,209 | 7,185 | 73 | 20 | 3.81 |
| Elgeyo M. | 2,279 | 603 | 501 | 350 | 1,519 | 67 | 65 | 1.06 |
| Kajiado[2] | 19,605 | 3 | 308 | 3,019 | 3,330 | 17 | 7 | 8.40 |
| Kericho | 3,931 | 2,553 | 801 | 21 | 3,375 | 86 | 161 | 0.56 |
| Laikipia | 9,718 | 75 | 1,255 | 6,757 | 8,087 | 83 | 13 | 7.09 |
| Nakuru | 5,769 | 1,138 | 1,540 | 1,073 | 3,751 | 65 | 90 | 1.00 |
| Nandi | 2,745 | 1,136 | 790 | - | 1,926 | 70 | 109 | 0.65 |
| Narok | 16,115 | 2,179 | 3,256 | 6,438 | 11,873 | 74 | 13 | 5.93 |
| Trans Nzoia | 2,078 | 344 | 1,206 | 9 | 1,559 | 75 | 124 | 0.67 |
| Uasin Gishu | 3,378 | 328 | 2,453 | - | 2,781 | 82 | 89 | 1.11 |
| West Pokot | 9,090 | 522 | 846 | 3,487 | 4,855 | 53 | 17 | 3.64 |
| Samburu/Turkana | 79,289 | - | - | n.a.* | - | - | 3 | - |
| Central Province | 13,173 | 3,482 | 3,892 | 485 | 7,859 | 60 | 178 | 0.44 |
| Kiambu | 2,448 | 778 | 470 | 174 | 1,422 | 58 | 280 | 0.23 |
| Kirinyaga | 1,437 | 285 | 665 | 5 | 955 | 66 | 202 | 0.34 |
| Muranga | 2,476 | 961 | 847 | - | 1,808 | 73 | 261 | 0.29 |
| Nyandarua | 3,528 | 763 | 1,225 | 97 | 2,085 | 59 | 66 | 0.95 |
| Nyeri | 3,284 | 695 | 685 | 209 | 1,589 | 48 | 148 | 0.35 |

Table 2.1 continued:

| | Total Land Area (sq.km) | Agricultural Land[1] Humid & Sub-humid (Zones I & II) | Semi-humid & Transitional (Zones III & IV) | Semi-arid & Arid (Zones V & VI) | Total Agricultural Land | % of Total Land | Population Density (1979) (sq. km) | Agricultural Land/Person (ha) |
|---|---|---|---|---|---|---|---|---|
| Eastern Province | 155,759 | 1,035 | 9,194 | 28,438 | 38,667 | 25 | 17 | 5.06 |
| Embu | 2,714 | 161 | 639 | 1,213 | 2,013 | 74 | 96 | 0.82 |
| Meru | 9,922 | 743 | 2,127 | 2,447 | 5,317 | 54 | 83 | 0.71 |
| Machakos | 14,178 | 131 | 3,526 | 7,616 | 11,273 | 80 | 72 | 1.23 |
| Kitui | 29,388 | - | 2,902 | 17,162 | 20,064 | 68 | 15 | 4.43 |
| Isiolo/Marsabit | 99,557 | - | - | n.a.* | - | - | 1 | |
| Coast Province | 83,040 | 275 | 9,359 | 24,701 | 34,335 | 41 | 16 | n.a.* |
| Taita/Taveta | 16,959 | 40 | 663 | 5,139 | 5,842 | 34 | 8 | 4.23 |
| Kivale | 8,257 | 235 | 1,850 | 5,228 | 7,313 | 89 | 34 | 2.65 |
| Kilifi | 12,414 | - | 2,541 | 4,572 | 7,113 | 57 | 34 | 1.81 |
| Tana River[3] | 38,694 | - | 418 | 8,132 | 8,550 | 22 | 2 | 27.68 |
| Lamu | 6,506 | - | 3,887 | 1,630 | 5,517 | 85 | 6 | 16.27 |
| N.E. Province | 126,902 | - | - | n.a.* | - | - | 2 | n.a.* |
| Total (Kenya) | 563,480 | 23,500 | 43,152 | 80,382 | 147,034 | 26 | 27 | |

n.a.* - not available

1) Zones I & II humid/sub-humid: tea, coffee, pyrethrum, horticulture, dairying.

Zones III & IV semi-humid/transitional: maize, wheat, pulses, oilseeds, cotton, dairying, cashew/coconut (coast).

Zones V & VI semi arid/arid: sorghum, millet, cotton, pulses, oilseeds; ranching cattle, sheep, and goats; wildlife resources.

2) Data on agricultural land only, including the southeastern part of Kajiado.

3) Data on agricultural land only, including the southeastern part of Tana River.

Source: Farm Management Handbook of Kenya Vol. II; Statistical Abstract 1983.

Table 2.2: MOISTURE AVAILABILITY ZONES
With an indication of rainfall, evaporation, and major limitations

| Zone | r/80 (%) | Classification (excluding areas above 3000m in altitude) | average annual rainfall (mm) | average annual potential evaporation (mm) | major limitations to maximum production in approximate order of importance |
|---|---|---|---|---|---|
| I | 80 | humid | 1100-2700 | 1200-2000 | soil fertility, husbandry, drainage |
| II | 65-80 | sub-humid | 1000-1600 | 1300-2100 | soil fertility, husbandry, drainage |
| III | 50-65 | semi-humid | 800-1400 | 1450-2200 | soil fertility, husbandry, rainfall |
| IV | 40-50 | semi-humid to semi-arid | 600-1100 | 1550-2200 | husbandry, rainfall, soil fertility |
| V | 25-80 | semi-arid | 450- 900 | 1650-2300 | rainfall, husbandry, soil fertility |
| VI | 15-25 | arid | 300- 550 | 1900-2400 | rainfall |
| VII | M15 | very arid | 150- 350 | 2100-2500 | rainfall |

management. The basic approach should be to break away from being tied to seasonal systems and to move to systems which place reliance on soil moisture reserves to increase crop production in lower rainfall environments and in bad years. This will call for intensive and creative research in the whole area of watershed management runoff reduction, tillage, residue retention, crop and fallow sequences, water balance, and crop agronomy. This work must be aware of commercial agricultural constraints but must not be so shackled by them that new concepts cannot emerge. This work, like soil fertility research, should have central and regional inter-related projects and should involve significant on-farm research.

Soil Fertility Research

Closely related to soil and water management, are studies in the field of soil fertility. Declining soil fertility is one of the most important reasons for the declining productivity of crops in Kenya. This has been rated as a major limitation in the high-potential areas and an important limitation in the medium- and low-potential areas. The Mission proposes the setting up of a soil fertility studies network by linking together a number of national and regional research centers for this purpose. Similarly, a coordinated agronomic experiment project is proposed to generate recommendations on a national basis in respect to current and more efficient use of chemical fertilizers. Fertilizers are going to have a key role both in irrigated and non-irrigated agriculture in Kenya, and it is important that their use be standardized, the optimum dosages determined, and a great deal of efficiency achieved in the process.

With respect to legumes in cropping systems, the coordinated agronomic experiments should pay particular attention to the role of fodder, and again legumes, in building soil fertility through fixation of atmospheric nitrogen.

Irrigation and Drainage Research: The Government of Kenya has clearly stated that development of irrigation will receive priority even though it is a costly venture. The government feels that this one-time investment could go a long way in stabilizing agricultural production. Of the total irrigation potential of 0.9 million hectares in the country, only 0.54 million hectares can be developed in practical terms, and the plans at present are that Kenya should have 0.16 million hectares of irrigated lands at the end of the century, compared to the present 40,000 hectares. With the creation of this additional irrigation potential, part of the 70% or more of Kenya's semi-arid and arid lands can be brought under cultivation (Annex II).

With further development of irrigation and drainage, the unutilized and under-utilized one million hectares of land which suffer from problems of waterlogging and impeded drainage should be able to contribute to agricultural production.

In the face of these major developments, the agricultural scientists in Kenya should be evolving new research priorities in the field of more efficient use of irrigation water. In the Kenyan context, irrigation will always remain a costly venture; its cost could become prohibitive if this resource is not efficiently used. Elsewhere in this report we have proposed the setting up of a national center for research on irrigation and drainage.

Priorities in Crop Research

Table 2.3 lists the more important crops and commodities of Kenya - their 1981 levels of production and their estimated demand in 2000 AD, when the population will have reached the 30-million mark. The table also gives the growth rates of production for each of these commodities if the demand is to be met from internal sources. The analysis has been extended in the following table (Table 2.4) which gives the required rates of growth, taking 1980 as the base year. It is clear that the required growth rate varies considerably, depending on the base year. The analysis as a whole leads to a number of conclusions which have an important bearing on research priorities. These are that:

1. Kenya must intensify its research efforts to provide support for the production programs on commodities as indicated in Table 2.3. The growth rates required to achieve self-sufficiency, even at the present levels of consumption, which are not high, suggest that accelerated progress both in research and development is imperative.

2. Maize is the most important food crop of Kenya and would remain so in the foreseeable future. More than any other crop, research should help to attain self-sufficiency in this food grain of great national significance. Maize production, which saw a significant advance in the 1960s, has shown a declining trend in later years. The hybrid maize technology needs to be improved and diversified and a careful assessment made of the areas of adaptation of this crop. It is well known that maize is not well adapted to dryland conditions and to low levels of management. While it will not be prudent to restrict maize research to the more favorable agro-ecological zones of Kenya, the long-term strategy should be to replace maize with better-adapted crops like sorghum and millet in the drylands on the basis of the performance of these crops in difficult environments. Table 2.5 shows the cultivation and production of maize in the different agro-ecological zones, and it will be seen that the contribution of semi-arid and arid lands where maize at present is widely cultivated is rather limited.

3. Next to maize, wheat is the most important component of the Kenyan diet, and even with the more favorable base year of 1981, its production must see an annual growth rate of more than 5% to attain the demand targets for 2000 AD. On a long-term basis, the role of wheat in Kenya's diet should increase as it has done in so many other countries. Also, few crops have a more effective and dependable production technology; so wheat in Kenya should be able to take full advantage of these advances. It is not true that available wheat technology is more suitable for large farms. The technology, in fact, is scale neutral, and in many countries of Asia wheat farmers who are even smaller than their counterparts in Kenya have been able to double their yields in the last 15 years.

Sorghum and Millet: These two crops which are better adapted to dryland conditions than most other cereals should normally find an important place in Kenya's agriculture. The fact that they do not do so has much to do with the dietary patterns, which do not favor these crops. The most important scientific challenge is to develop high-yielding hybrid strains and improved varieties, as has been done in

Table 2.3: Projected Food Demand in 2000 AD, Current Production Levels, and Growth Rates Required to Meet Projected Demand

| CROP | ESTIMATED PRODUCTION IN 1981 | DEMAND[2] IN 2000 AD (,000 tonnes) | REQUIRED GROWTH RATE TO MEET DEMAND[3] |
|---|---|---|---|
| MAIZE | 2560 | 4009 | 2.8 |
| MILLET & SORGHUM | 152 | 484 | 10.9 |
| WHEAT | 233 | 484 | 5.4 |
| RICE | 39 | 161 | 15.6 |
| IRISH POTATOES | 644 | 783 | 1.1 |
| CASSAVA | 672 | 774 | 0.7 |
| SUGAR | 440 | 454 | 0.2 |
| PULSES | 406 | 481 | 0.9 |
| MILK[1] | 1649 | 2620 | 2.9 |
| MEAT[1] | 285 | 694 | 7.2 |
| FATS & OILS[1] | 52 | 105 | 5.1 |

[1] Estimates for 1983. Fats and oils production includes vegetable sources only.

[2] Scenario 3: average annual per capita income in urban and rural sectors unchanged and a high population growth estimate.

[3] Projections from McCarthy, F.D. and Mwangi, W.M. (1982). Kenya agriculture: toward 2000. International Institute for Applied Systems, Analysis: Laxenburg, Austria.

Table 2.4: Domestic Requirements of Main Foodstuffs in 1989 and Rates of Growth of Production Necessary to Achieve Self-sufficiency

| COMMODITY | ESTIMATED PRODUCTION IN 1980 (,000 tonnes) | ESTIMATED DOMESTIC REQUIREMENT IN 1989 (,000 tonnes) | ANNUAL PRODUCTION GROWTH RATE FOR SELF-SUFFICIENCY % |
|---|---|---|---|
| 1. MAIZE (a) 1980 production as base | 1,620 | 3,514 | 9.0 |
| (b) 1976 production as base | 2,264 | 3,514 | 4.9 |
| (c) Mean of 76 & 80 as base | 1,942 | 3,514 | 6.8 |
| 2. WHEAT FLOUR | 142 | 493 | 14.8 |
| 3. SORGHUM/MILLET | 369 | 563 | 4.8 |
| 4. RICE | 23 | 90 | 16.4 |
| 5. BEANS | 140 | 344 | 10.5 |
| 6. POTATOES | 450 | 828 | 7.0 |
| 7. SUGAR | 4,402 | 571 | 4.0 |
| 8. BEEF | 147 | 314 | 8.8 |
| 9. MILK | 1,259 | 2,058 | 5.6 |

Source: Kenya, Sessional Paper No.4, 1981, National Food Policy

Table 2.5: The Areas Under Major Crops, in Relati to the Extent of Ecological Zones, Suitable and Highly Suitabl. for Such Crops

| CROPS | Actual Area (,000 ha; 1981) | Suitable Ecological zones[1]: | Extent ,000 ha | Actual area as % of suitable area | Highly Suitable Ecological Zones: | Extent ,000 ha | Actual area as % of suitable area |
|---|---|---|---|---|---|---|---|
| Maize | 1,230 | LH1-3 UM1-4 LM1-4 L2-4 | 5,828 | 21 | LM2 UM1-2,4 L2 | 1,846 | 67 |
| Wheat | 124 | UH2-3 LH2-4 | 1,663 | 7 | UH3 LH3 | 707 | 18 |
| Sorghum | 105 | UM4-5 LM4-5 L4-5 | 6,330 | 2 | UM5 | 717 | 15 |
| Millet | 75 | UM4 LM5 L4-5 | 4,804 | 2 | LM5 | 2,354 | 3 |
| Irish Potatoes | 61 | N.A. | | | LH1 | 325 | 19 |
| Sunflower | 14 | UM1-4 LM1-4 L2-4 | 4,622 | 0.3 | UM4 | 768 | 2 |
| Cotton | 142 | LM3-4 L3-4 | 2,144 | 7 | LM3 L3 | 681 | 21 |
| Pyrethrum | 31 | UH2 LH2 | 595 | | UH2 | 290 | 11 |
| Tea | 75 | LH1 UM1 | 662 | 11 | LH1 | 325 | 22 |
| Coffee | 117 | UM1-3 | 958 | 12 | UM2 | 333 | 35 |
| Sugarcane | 113 | LM1-2 L2 | 752 | 15 | LM1 L2 | 368 | 31 |
| Sisal | 108 | UM4-5 LM3-4 L4 | 3,410 | 3 | UM4 LM4 L4 | 2,231 | 5 |
| Coconuts | 34 | L2-3 | 242 | 14 | L3 | 219 | 16 |
| Cashew | 29 | L4 | 654 | 4 | L4 | 654 | 4 |

[1] UH - Upper Highland; LH - Lower Highland; UM - Upper Midland; LM - Lower Midland; L - Lowland.
1 - Humid; 2 - Sub-humid; 3 - Semi-humid; 4 - Transitional; 5 - Semi-arid; 6 - Arid.

Source: Derived from Farm Management Handbook of Kenya, Vol. II.

other parts of the world. This should be first attempted at one major center rather than spreading the work all over the country. Once the viability of the new technology, its acceptance, and its relative profitability in relation to other crops for some of the agro-ecological regions is well established, a larger program of research with most centers participating in it can be organized.

Rice: In the agro-ecological context of Kenya, rice cultivation is assuming increasing importance, and is now regarded the third major food grain crop after maize and wheat. Present demands far outstrip production and rice contribution to diet is likely to increase substantially in the very near future. While some of the current demand can be met from intensive programs of production in the newly developed and expanding irrigation projects, there will be the need to emphasize the adoption and adaptation of improved technologies, some of which are available from the programs of the International Rice Research Institute (IRRI), the International Institute of Tropical Agriculture (IITA), and the West African Rice Development Association (WARDA). Initial work on adaptive research and testing should be consistently maintained, monitored, and expanded as demand grows.

Pulses: If maize is to be the staple food of Kenya, it is important that the poor nutritive value of its protein is balanced with pulses, which for economic and other reasons should become a more important source of protein in the Kenyan diet. The maize protein is poor in lysine -- an essential amino acid required for body growth. Most pulses are rich in lysine and can supplement the essential amino acids commonly present in cereal grains.

There is another reason for research in pulses to receive high priority. Nitrogenous fertilizers have a key role in increasing agricultural production in Kenya, both in the irrigated and non-irrigated lands. Fertilizer nitrogen, however, is a costly input, and some of these requirements should be met from biologically fixed nitrogen. The research strategy in Kenya should be to evolve short-duration varieties of pulses which can be fitted into inter, multiple, and relay cropping patterns.

Oilseeds: Kenya is highly dependent on importation of edible oils, and these imports are expected to increase with the years. Table 2.6 shows the import cost for vegetable oils and fats for two 3-year periods, 1975-1977 and 1980-1982. The import costs for some of the other commodities are also shown in this table.

It is clear that during the 3-year period of 1980-1982, vegetable oils and fats accounted for the largest import bill of KSh.19,525,000, followed by maize (14.29 million) and feeds (7.78 million). Kenya's import bills for vegetable fats could begin to place a heavy burden on the country's foreign exchange resources, unless research and development help to increase the production of oilseed crops. These data also provide further support for higher research priority for research on maize and wheat.

Fruits and Vegetables: Horticultural crops, next only to coffee and tea, account for the largest export earnings in Kenya. This can be seen from Table 2.7, which give the export figures for the principal agricultural commodities for 1975-1977 and 1980-1982.

Table 2.6: IMPORTS, Principal agricultural commodities and derived products

| Three-year periods | 1975-77 Quantity (tonnes) | 1975-77 Value (K£'000) | 1980-82 Quantity (tonnes) | 1980-82 Value (K£'000) |
|---|---|---|---|---|
| Food Products: | | | | |
| Milk (dry) | 1,019 | 335 | 9,436 | 4,342 |
| Fish (products) | 1,734 | 524 | 451 | 170 |
| Wheat (unmilled) | 40,242 | 2,063 | 79,009 | 7,789 |
| Maize (unmilled) | 140 | 6 | 163,441 | 14,198 |
| Rice | 3,343 | 407 | 5,897 | 1,400 |
| Fruit & Vegetables | 5,042 | 1,023 | 1,969 | 1,645 |
| Sugar, refined | 31,506 | 4,686 | 1,908 | 495 |
| Sugar, confectionary | 15 | 11 | 6 | 7 |
| Tea | 4,304 | 3,188 | 8,192 | 4,333 |
| Total food products | | 13,712 | | 39,319 |
| Oils & Fats: | | | | |
| Animal oils & fats | 13,391 | 2,580 | 14,103 | 4,237 |
| Vegetable oils & fats | 33,187 | 7,340 | 91,346 | 19,525 |
| Oils & fats, processed | 4,045 | 1,085 | 1,486 | 571 |
| Total oils & fats | | 11,006 | | 24,333 |
| Natural Fibres: | | | | |
| Cotton, yarn & thread | 270 | 266 | 19 | 24 |
| Cotton, piece goods('000sqm) | (2,381) | 1,140 | (730) | 513 |
| Jute (incl.cuttings,waste) | 9,690 | 1,145 | 10,925 | 1,565 |
| Jute, bags & sacks (x1000) | (710) | 124 | - | - |
| Total cotton & jute products | | 2,675 | | 2,102 |
| Farm Inputs: | 1974/76 | | | |
| Insecticides,fungicides,etc. | 20,074 | 4,833 | 46,454 | 9,600 |
| Manufactured fertilizers: | | | | |
| Nitrogenous | 56,375 | 4,531 | 65,210 | 6,534 |
| Phosphatic | 37,257 | 3,352 | 29,939 | 3,757 |
| Other | 34,107 | 3,012 | 60,829 | 8,216 |
| Total insecticides, fertilizers, etc. | | 15,728 | | 28,107 |
| Sum of the above imports | | 43,121 | | 93,861 |
| TOTAL IMPORTS | | 343,541 | | 930,580 |

Source: Central Bureau of Statistics; Statistical Abstract 1983.

Table 2.7: EXPORTS, Principal agricultural commodities and derived products

| Three-year periods | 1975-77 Quantity (tonnes) | 1975-77 Value (K£'000) | 1980-82 Quantity (tonnes) | 1980-82 Value (K£'000) |
|---|---|---|---|---|
| **Food Products:** | | | | |
| Live animals (number x1000) | (1,625) | 1,138 | (340) | 1,523 |
| Meat & meat prep. | 9,133 | 7,039 | 2,020 | 2,909 |
| Milk & cream | 802 | 1,504 | 45 | 57 |
| Butter & ghee | 1,119 | 586 | 558 | 595 |
| Eggs (number x1000) | (2,363) | 71 | (1,742) | 82 |
| Fish & fish prep. | 639 | 403 | 979 | 822 |
| Maize (unmilled) | 80,726 | 3,788 | 653 | 133 |
| Cashew nuts | 8,990 | 755 | 6,098 | 1,668 |
| Pineapples, tinned | 31,746 | 7,033 | 39,757 | 11,784 |
| Beans, peas, etc. | 17,513 | 2,239 | 18,304 | 3,248 |
| Other fruits & vegetables | N.A. | 6,268 | N.A. | 15,257 |
| Total food products | | 30,824 | | 38,078 |
| **Beverages:** | | | | |
| Coffee | 79,825 | 110,948 | 89,047 | 120,688 |
| Tea | 60,679 | 42,158 | 76,854 | 65,567 |
| Total beverages | | 153,106 | | 186,255 |
| **Oils & Fats:** | | | | |
| Oil seeds & nuts | 5,965 | 939 | 7,965 | 1,512 |
| Anim. & veg. oils & fats | 1,728 | 769 | 1,035 | 487 |
| Total oils & fats | | 1,708 | | 1,999 |
| **Natural Fibres:** | | | | |
| Wool, raw | 1,293 | 577 | 1,424 | 1,048 |
| Cotton, raw | 1,952 | 953 | 2,192 | 1,414 |
| Sisal fibre & tow | 32,339 | 5,246 | 39,061 | 9,483 |
| Textile yarns, fabrics | N.A. | 1,938 | N.A. | 1,801 |
| Total natural fibres | | 8,714 | | 13,746 |
| **Miscellaneous:** | | | | |
| Pyrethrum products (flowers & extract) | | 5,923 | | 8,274 |
| Animal feeds | 20,193 | 1,066 | 8,234 | 477 |
| Hides and skins, undressed | 12,491 | 7,333 | 10,862 | 8,885 |
| Total miscellaneous | | 14,322 | | 17,636 |
| Sum of the above exports | | 208,674 | | 257,714 |
| TOTAL EXPORTS | | 343,541 | | 515,748 |

Source: Central Bureau of Statistics; Statistical Abstract 1983.

It should, however, be recognized that much of this export is based on private enterprise initiative, and horticultural research itself has received less attention in the country. One major consequence of this is that the intake of fruits and vegetables by the Kenyans is extremely low, as can be seen from Table 2.8.

The demand for domestic consumption of fruits and vegetables will be 3- to 4-fold higher in the year 2000 AD. Thus the need now is to evolve a national policy which clearly lays down targets of domestic and export needs in the coming years and the research and development infrastructure which will be needed to support this production and export program. The national fruit and vegetable research center at Thika, whose mandate is extremely diffuse at present, should be made to evolve a sharp focus in line with the national policies on efficient resource utilization and export promotion.

Cotton

Cotton will continue to be a priority fibre crop in view of its contributions to export earnings and the processing industry of cotton yarn, thread and cloth. Emphasis should continue to be on early to medium maturing cultivars with long staple and under both rainfed and irrigated conditions. There is need to strengthen work on production technologies, in particular agronomy, crop nutrition, and pest management. Although cotton production areas are not expected to expand in a major way in the medium term, there is need to improve productivity through breeding and selection, variety introduction, agronomy, and integrated pest management. Production systems research at RRCs should also focus on the testing and adoption of improved technologies for cotton production in the small-scale farms.

Plantation Crops

Plantation crops in Kenya are dominated by coffee and tea. It is obvious that Kenya has done well in this field, largely because of research and management support which the coffee and tea industries enjoy in the country. Even so, considering the contribution these two crops make to the stability of the country's economy, a long-term perspective of research and development needs to be evolved. The world demand for coffee and tea should increase with increasing populations. Kenya should be able to maintain its share of exports, and if possible, to increase it. This will not be easy, because of the increasing domestic demands at the same time as has happened in other exporting countries, like India, in recent years. Also, new techniques in production and management, such as those in the field of tissue culture, will offer exciting possibilities which scientists in Kenya should be able to harness and exploit in their programs.

Small-Farm Situation

There is much concern in Kenya about the research needs of the emerging class of small farmers. It has been suggested that research has not sufficiently reorientated its thinking in terms of the relevance of improved technologies to the needs of these small farmers and that much remains to be done. While there may be some truth in this, the problem requires a more detailed analysis. Table 2.9 describes the emerging small-farm problem in Kenya over a period of time. First it will be noted that most farms in 1979 were small, as many as 98% of the total.

Table 2.8: Estimated per capita food consumption and projected demand

| Selected Food Items | Average annual per capita comsumption Rural[1] | Urban[2] | Total | Total demand 1975 | Projected demand[3] 1990 | 2000 | Estimated total demand National Food Policy Paper (1989) |
|---|---|---|---|---|---|---|---|
| | Kg | | | '000 tonnes | | | |
| Wheat - bread & flour | 9.6 | 31.1 | 12.1 | 163 | 339 | 433 | 493 |
| Rice | 1.4 | 6.1 | 2.0 | 26 | 54 | 69 | 90 |
| Maize - flour | 114.2 | 70.2 | 113.3 | 1,508 | 3,137 | 4,004 | 3,514 (grain) |
| Other cereal - flour | 18.5 | 5.9 | 16.8 | 230 | 478 | 610 | 563 |
| Irish Potatoes | 20.6 | 14.7 | 19.9 | 270 | 562 | 717 | 828 |
| Other Roots | 66.0 | 16.2 | 60.0 | 814 | 1,693 | 2,161 | - |
| Sugar (raw & cane) | 11.6 | 18.9 | 12.4 | 169 | 352 | 449 | 571 |
| Beans | 11.3 | 10.5 | 11.2 | 151 | 314 | 401 | 344 |
| Vegetables | 17.8 | 52.6 | 22.0 | 298 | 620 | 791 | - |
| Bananas | 11.5 | 20.2 | 12.5 | 170 | 354 | 452 | - |
| Other fruits | 16.4 | 23.0 | 17.2 | 233 | 485 | 619 | - |
| Vegetable oils | 0.8 | 2.3 | 1.0 | 14 | 29 | 37 | - |
| Animal fats & oils | 0.1 | 1.9 | 0.4 | 5 | 10 | 13 | - |
| Butter | 0.1 | 1.7 | 0.3 | 4 | 8 | 10 | - |
| Milk | 48.7 | 41.7 | 47.8 | 649 | 1,350 | 1,723 | 2,058 |
| Beef | 6.8 | 11.9 | 7.4 | 100 | 208 | 265 | 314 |
| Other meat | 5.9 | 6.5 | 6.0 | 81 | 168 | 214 | - |
| Eggs | 0.8 | 2.1 | 0.9 | 12 | 25 | 32 | - |
| Fish | 1.7 | 7.9 | 2.5 | 33 | 69 | 88 | - |

Nutritional status:

| | | | |
|---|---|---|---|
| Calories per day | 2069 | 2051 | 2068 |
| Protein per day (gms) | 56.9 | 57.8 | 57.1 |
| Fats per day (gms) | 27.1 | 40.4 | 28.7 |

[1] Total rural population (1975, excl. pastoralists) 11,936,000

[2] Total urban population (1975) 1,634,000

[3] On the basis of a universal 5% annual growth rate.

Source: Derived from Shah M.M. and Frohberg H.: Food consumption pattern - Rural and Urban Kenya: IIASA, Laxenburg, Austria.

Table 2.9: Number of farms by category and by province, and their percentage distribution by size (1979)

| Province/ | Western/ | Nyanza/ | Rift V./ | Central/ | Eastern/ | Coast | National Total | Total area 1,000 ha |
|---|---|---|---|---|---|---|---|---|
| | | | SMALLHOLDINGS | | | | | |
| Farm size (ha) | | | (percentage distribution by size) | | | | | |
| 0-1 | 63 | 74 | 66 | 69 | 60 | 58 | 67 | |
| 1-4 | 32 | 23 | 20 | 27 | 33 | 31 | 26 | |
| 4-8+ | 5 | 3 | 14 | 4 | 7 | 11 | 7 | |
| | 100 | 100 | 100 | 100 | 100 | 100 | 100 | |
| No. of farms (x1,000) | 342 | 708 | 527 | 501 | 456 | 160 | 2,694 | (3,216) |
| | | | INTERMEDIATE FARMS | | | | | |
| 8-50 ha No. of farms (x1,000) | 4 | 5 | 29 | 4 | 10 | 1 | 53 | (1,040) |
| | | | LARGE FARMS | | | | | |
| (ha) | | | (percentage distribution by size) | | | | | |
| below 200 | 36 | 78 | 44 | 75 | 46 | 49 | 54 | ( 112) |
| 200-2,000 | 45 | 18 | 51 | 22 | 23 | 35 | 48 | ( 895) |
| over2,000 | 19 | 4 | 5 | 3 | 31 | 16 | 6 | (1,652) |
| | 100 | 100 | 100 | 100 | 100 | 100 | 100 | |
| No. of farms | 11 | 116 | 2,327 | 1,067 | 163 | 51 | 3,735 | (2,569) |
| | | | ALL FARMS | | | | | |
| Total No. of farms (x1,000) | 346 | 713 | 558 | 506 | 466 | 161 | 2,751 | (6,915) |

Source: Central Bureau of Statistics; The Integrated Rural Surveys (1976-1979); Agricultural Census of Large Farms (1979 & 1980).

There were less than 0.2 percent large farms left in 1979. The distribution of small farms in different holding groups shows that over a period of 5 years from 1974-1979 there has been a great deal of fragmentation of land. Thus, in 1979 as many as 67% of all small farms were less than 1 hectare. This is very different compared to the situation in 1974 when only 32% of the small farms belonged to less than one hectare category and majority in fact fell in the range of 1 - 4 hectares. It is clear that the land in Kenya is rapidly getting subdivided and small farms of 1 hectare or less will be the order of the day in the coming years. In this respect, Kenya should soon be reaching a situation similar to that of some parts of India and countries like Japan where population pressures and limitations of land have led to small-size farms.

With regard to the technological needs of small farms, it is important to clarify that these needs are not always different from those of other groups of farmers. In fact, a small farmer often has to use a more advanced technology because he is under greater compulsion to maximize his production from a small piece of land, and so cannot afford to ignore the latest advances in production technology. The problem often is not one of non-availability of technology, although it is recognized that some adjustments may be necessary. A small farmer of necessity has to be more efficient, for his resources are limited. He cannot afford to take risks to any great extent. The real challenge in the small-farm situation, therefore, is one of creating a management infrastructure which will make it possible for the small farmers to have access to modern farm inputs like improved seeds, chemical fertilizers, pesticides, and improved farm tools. These inputs are indispensable for both small and large-scale farmers if production is to increase, and in the present context of Kenya's agriculture there appears to be no alternative. Secondly, it should be stressed that experience in many parts of the world has shown that small farmers in general have higher crop yields than large-scale farmers. This follows simply from the fact that the small farmer can take better care of his limited land, he can carry out his farm operations in a timely manner, his needs are not great in terms of volume and are more manageable provided the resources are available. The new technology for small farmers must therefore keep in mind the fact that small farmers can be highly productive. Small farmers also need a more diversified system of production to be able to take care of their diverse needs. However, as agriculture develops and a market economy is strengthened, this compulsion will not be so great.

## Stability of Production

The tremendous fluctuation which Kenya's agriculture shows in its productivity and production from year to year is perhaps its most characteristic feature at present. It is also the cause of the greatest concern. In this uncertain situation, it becomes extremely difficult for the government to plan its national policy in terms of imports and exports, in terms of goals of self-sufficiency, and above all in terms of the evolution of a more secure agriculture in the years to come. Research priorities must therefore be sought in terms of stability of crop yields. The scientists should be concentrating on those technologies which not only help increase productivity but also the ones which help to stabilize it. Research in the field of soil and water management offers perhaps the greatest promise in this regard. However, agronomists, plant breeders, entomologists, pathologists, and others also have important contributions to make. Kenya farmers require varieties of

crop plants which do well under optimum conditions but whose yields will not be depressed to a great extent if the conditions are sub-optimal, as they are bound to be on the fields of many small farmers. The situation here is very different from that in the Western countries, where inputs of various kinds are assured. Research priorities must therefore be given considerable thought in the further development and implementation of the agricultural research strategy and plan.

Priorities in Animal Production Research

The general principles that should be observed with regard to priorities in animal production research are as follows:

On a livestock type basis, the highest priority should be awarded to investigation of the problems of cattle production, as almost 80 percent of all grazing livestock units in the country are derived from cattle (Table 2.10), cattle are managed in all except the most arid districts, and milk and beef are the two most important animal protein foods. Although camels, sheep, and goats provide almost equal numbers of grazing livestock units (Table 2.10), investigation of the problems of sheep and goat production must be given priority over investigation of the problems of camel production because these two species are managed in every climatic zone and district, whereas camels are only managed by pastoralists in the drier pastoral districts. Pig and poultry research must be given a lower priority than research on ruminant livestock, as ruminants can convert roughages into human foods, whereas pigs and poultry are to a limited extent competitors for some foods. As poultry are reared by all farmers, with the exception of the majority of pastoralists (Table 2.11), and pig production is concentrated in Central and Rift Valley provinces, investigation of the problems of poultry production should be granted some priority over the problems of pig production. Rabbit research would have the lowest priority on a livestock-type basis.

On an animal production component basis, animal breeding research is different both in the time scales involved and in locations at which it should be organized. Animal nutrition, physiology, and management research can be conducted almost entirely at research centers, whereas animal breeding research will have to be organized both at research centers and on parastatal and private farms. Livestock systems research should be organized from RRCs, and animal health research would be conducted at research centers and in cooperation with the provincial and district veterinary services. In general, such research should be problem-solving oriented, with a focus on greater small-scale production.

It is not usually possible to allocate priorities between the different components of animal production research. However, program priorities can and should be awarded within specific components. As between components, it should be noted that improvements within one component often depend upon improvements within other components. For example, it would be of little use conducting breeding, nutrition, physiology, and management studies if major epidemic diseases are not controlled. Similarly, it is of no use breeding livestock of high genetic merit for production if insufficient feed is available.

Table 2.10: Grazing species livestock units by province, 1981

| Province | Camels | Cattle | Sheep | Goats | Donkeys | Totals | Province LSUs as % total |
|---|---|---|---|---|---|---|---|
| | | | '000 LSUs* | | | | |
| Nairobi | - | 2.9 | 0.1 | 0.1 | 0.1 | 3.2 | neg. |
| Central | - | 643.7 | 45.2 | 16.1 | 2.0 | 257.0 | 8 |
| Coast | 43.1 | 523.2 | 16.4 | 60.2 | 3.7 | 646.6 | 7 |
| Eastern | 168.0 | 1047.5 | 115.5 | 182.9 | 39.1 | 1553.0 | 17 |
| Northeastern | 292.0 | 480.2 | 52.2 | 52.3 | 5.5 | 882.2 | 9 |
| Nyanza | - | 1071.3 | 31.[illegible] | 60.9 | 4.0 | 1167.2 | 12 |
| Rift Valley | 133.9 | 2900.7 | 329.3 | 344.8 | 125.3 | 3834.0 | 41 |
| Western | - | 486.1 | 10.7 | 11.0 | 0.6 | 508.4 | 6 |
| Totals | 637.0 | 7205.6 | 600.4 | 728.3 | 180.3 | 9351.6 | |
| Grazing species as % Total | 7 | 79 | 6 | 8 | 2 | | |

Notes: *1 LSU (livestock unit) = 0.7 zebu cattle; 1.0 grade milking or beef cattle; 0.1 hair sheep; 0.15 wool sheep; 0.1 meat goat; 1.0 camel; and 0.5 donkey.

Source: Animal Production Branch (1982). Annual Report 1981. MLD: Nairobi.

Table 2.11: Estimates of livestock numbers, 1981

| PROVINCE District | Number of Livestock ('000 head) Camels | Cattle | Sheep | Goats | Donkeys | Pigs | Poultry | Rabbits |
|---|---|---|---|---|---|---|---|---|
| NAIROBI | - | 3 | 0.6 | 0.8 | 0.2 | 3.3 | 40 | 5.6 |
| CENTRAL | | | | | | | | |
| Kiambu | - | 117 | 27 | 17 | 1.2 | 13.0 | 441 | 7.1 |
| Kirinyaga | - | 80 | 43 | 36 | 0.2 | 4.9 | 191 | 14.0 |
| Murang'a | - | 189 | 63 | 60 | 0.2 | 11.6 | 474 | 5.8 |
| Nyandarua | - | 186 | 171 | 21 | 0.3 | 0.2 | 145 | 2.0 |
| Nyeri | - | 165 | 61 | 27 | 2.0 | 5.2 | 222 | 7.7 |
| Provincial totals | | 737 | 365 | 161 | 3.9 | 34.9 | 1,473 | 36.6 |
| COAST | | | | | | | | |
| Kilifi | - | 150 | 49 | 180 | 0.2 | 0.4 | 299 | 0.8 |
| Kwale | - | 120 | 58 | 160 | 0.3 | - | 208 | 0.2 |
| Lamu | 0.1 | 39 | 8 | 10 | 1.5 | - | 92 | - |
| Mombasa | - | 5 | 1 | 2 | - | 0.1 | 85 | 0.1 |
| Taita Teveta | - | 77 | 28 | 120 | 0.2 | 0.3 | 91 | 5.4 |
| Tana River | 43.0 | 346 | 20 | 130 | 5.0 | - | 40 | 0.1 |
| Provincial totals | 43.1 | 737 | 164 | 602 | 7.2 | 0.8 | 815 | 6.6 |
| EASTERN | | | | | | | | |
| Embu | - | 71 | 24 | 73 | 0.5 | 5.0 | 231 | 1.6 |
| Isiolo | 17 | 235 | 295 | 300 | 15.0 | - | 7 | - |
| Kitui | 4 | 203 | 82 | 298 | 4.0 | 0.1 | 446 | 0.4 |
| Machakos | - | 423 | 220 | 528 | 4.6 | 0.2 | 998 | 3.7 |
| Marsabit | 147 | 152 | 337 | 500 | 44.0 | - | 5 | - |
| Meru | - | 382 | 197 | 130 | 10.0 | 4.5 | 717 | 4.4 |
| Provincial totals | 168 | 1466 | 1155 | 1829 | 78.1 | 9.8 | 2,399 | 10.1 |
| NORTH EASTERN | | | | | | | | |
| Garissa | 36 | 431 | 368.2* | | 4.5 | - | 5 | - |
| Mandera | 111 | 92 | 394.2* | | 3.1 | - | 1 | - |
| Wajir | 145 | 163 | 282.7* | | 3.3 | - | 4 | - |
| Provincial totals | 292 | 686 | 1045.1* | | 10.9 | - | 10 | - |
| NYANZA | | | | | | | | |
| Kisii | - | 414 | 120 | 98 | 0.3 | 0.1 | 950 | 0.6 |
| Kisumu | - | 164 | 82 | 91 | 0.1 | 0.2 | 766 | 0.2 |
| Siaya | - | 384 | 101 | 176 | 0.1 | 0.2 | 1,272 | 0.1 |
| South Nyanza | - | 549 | 196 | 244 | 7.4 | 0.2 | 1,272 | 1.2 |
| Provincial totals | - | 1511 | 499 | 609 | 7.9 | 0.7 | 4,260 | 2.1 |

Table 2.11 continued

| PROVINCE District | Number of Livestock ('000 head) Camels | Cattle | Sheep | Goats | Donkeys | Pigs | Poultry | Rabbits |
|---|---|---|---|---|---|---|---|---|
| RIFT VALLEY | | | | | | | | |
| Baringo | 2.7 | 175 | 300 | 615 | 2.6 | 0.1 | 87 | 0.2 |
| Elgeyo Marakwet | - | 125 | 140 | 92 | 0.2 | - | 107 | 0.2 |
| Kajiado | - | 644 | 272 | 326 | 14.0 | 2.0 | 122 | 1.0 |
| Kericho | - | 633 | 300 | 260 | 18.1 | 0.9 | 721 | 0.3 |
| Laikipia | 0.2 | 300 | 200 | 60 | 0.8 | 2.0 | 117 | 0.3 |
| Nakuru | - | 233 | 272 | 127 | 3.0 | 1.4 | 484 | 1.0 |
| Nandi | - | 330 | 43 | 34 | 11.0 | 0.4 | 300 | 0.2 |
| Narok | - | 700 | 703 | 890 | 11.0 | - | 152 | - |
| Samburu | 23.0 | 205 | 200 | 246 | 6.9 | - | 2 | - |
| Trans Nzoia | - | 100 | 18 | 10 | 0.5 | 10.4 | 29 | 0.8 |
| Turkana | 108.0 | 147 | 500 | 600 | 177.0 | - | 1 | - |
| Uasin Gishu | - | 200 | 36 | 38 | 0.5 | 1.0 | 110 | 0.7 |
| West Pokot | 1.0 | 68 | 121 | 150 | 4.0 | - | 21 | 0.2 |
| Provincial totals | 134.9 | 3860 | 3105 | 3448 | 249.6 | 18.2 | 2,253 | 4.9 |
| WESTERN | | | | | | | | |
| Bungoma | - | 194 | 40 | 28 | 0.2 | 1.6 | 160 | 1.0 |
| Busia | - | 145 | 16 | 46 | 0.6 | 7.2 | 65 | 4.2 |
| Kakamega | - | 338 | 51 | 36 | 0.3 | 4.4 | 567 | 3.0 |
| Provincial totals | - | 677 | 107 | 110 | 1.1 | 13.2 | 792 | 8.2 |
| Kenya totals | 638.0 | 9671 | 5917.6 | 7282.8 | 358.9 | 80.9 | 12,042 | 74.1 |

Note: *Sheep and goats in North-eastern Province were counted together using aerial survey techniques; for the purpose of calculating national totals it was assumed that there were equal numbers of each species.

Source: Animal Production Branch (1982). Annual Report 1981. MLD: Nairobi.

Animal breeding

For reasons discussed in detail in Volume II of the Report, national animal breeding plans are now essential for the conservation and improvement of specific exotic and indigenous livestock breeds in Kenya.

It is recommended that a National Animal Breeding Council be established by government. The membership of this council should include representatives of the national agricultural research organization and the Animal Production Branch of MOALD, the Agricultural Development Corporation (ADC), the livestock breed societies, and prominent private livestock breeders. The coordinator of animal breeding programs in the national agricultural research organization should act as secretary to the council. The council would be charged with ensuring that programs are organized for the conservation and development of valuable exotic and indigenous livestock breeds on ADC properties, private farms and ranches, and MOALD research centers.

Details of all the proposed breeding programs are provided in Volume II of the Report, the breeding of acclimatized and productive dairy cattle suitable for smallholder management and continuation of the Sahiwal breeding program at Naivasha being priority programs.

Animal nutrition

Priority nutritional investigations would be concerned with the nutritional demands of grade milking cattle managed in different systems and agro-ecological zones and of work oxen, particularly during the dry season and working periods. Surveys of the potential total production of by-product feeds and their suitability, availability, and safety for all classes of livestock and a Kenya-wide survey of mineral deficiencies in livestock are also of importance, as are investigations into the possibility of improving the digestibility and hence the nutritional value of roughage feeds.

Animal physiology

Acclimatization investigations would be centered at Muguga, and the climatic physiologist would cooperate closely with animal breeders at Naivasha and the range scientists at Kiboko. Reproductive physiology investigations would be centered at Naivasha, and a first-priority program would be to survey the extent and causes of infertility in dairy cattle, particularly those in smallholder livestock systems.

Animal management and livestock systems studies

Animal management investigations would be conducted on an ad hoc basis in order to provide solutions for current managerial problems, and livestock systems studies would be conducted at all RRCs.

Priorities in pasture and fodder research

With a high density of ruminant livestock in high and medium potential districts (Table 2.12), shortage of adequate feed, particularly in the dry season, is a major constraint on achieving high productivity in grade dairy cattle, wool sheep, and dairy goats.

Table 2.12: Estimates of stocking rates and of the density of grazing livestock in the high and medium potential agricultural districts

| PROVINCE District | Total land area ($km^2$) | Area not cropped[1] ($km^2$) | Total domestic[2] livestock LSUs ('000) | Hectares available per LSU | Density of grazing livestock (LSU per ha) |
|---|---|---|---|---|---|
| CENTRAL | | | | | |
| Kiambu | 2448 | 1850 | 115.6 | 1.6 | 0.63 |
| Kirinyaga | 1437 | 710 | 84.2 | 0.8 | 1.12 |
| Muranga | 2476 | 1450 | 192.5 | 0.8 | 1.33 |
| Nyandarua | 3528 | 3100 | 198.3 | 1.6 | 0.64 |
| Nyeri | 3284 | 2410 | 166.4 | 1.4 | 0.69 |
| EASTERN | | | | | |
| Embu | 2714 | 1730 | 59.8 | 2 9 | 0.35 |
| Kitui | 29380 | 27268 | 190.4 | 12.2 | 0.08 |
| Machakos | 14178 | 10900 | 382.1 | 2.9 | 0.35 |
| Meru | 9922 | 7810 | 313.1 | 2.5 | 0.40 |
| NYANZA | | | | | |
| Kisii | 2196 | 940 | 315.4 | 0.3 | 3.36 |
| Kisumu | 2093 | 1340 | 129.6 | 1.0 | 0.97 |
| Siaya | 2522 | 1500 | 295.0 | 0.5 | 1.97 |
| South Nyanza | 5714 | 3610 | 427.2 | 0.8 | 1.18 |
| RIFT VALLEY | | | | | |
| Elgeyo Marakwet | 2279 | 1940 | 124.3 | 1.6 | 0.64 |
| Kericho | 3931 | 2971 | 591.5 | 5.0 | 0.20 |
| Nakuru | 5769 | 4820 | 231.5 | 2.1 | 0.48 |
| Nandi | 2745 | 2050 | 280.1 | 0.7 | 1.37 |
| Trans-Nzoia | 2078 | 1440 | 84.0 | 1.7 | 0.58 |
| Uasin Gishu | 3378 | 2310 | 169.5 | 1.4 | 0.73 |
| WESTERN | | | | | |
| Bungoma | 3074 | 1930 | 146.2 | 1.3 | 0.76 |
| Busia | 1626 | 840 | 110.6 | 0.8 | 1.32 |
| Kakamega | 3495 | 1510 | 251.6 | 0.6 | 1.67 |

Notes: [1] The area not cropped is calculated by deducting the total crop area from the total land area; it is not necessarily grazing land, although the major part of it will be.
[2] The total LSUs in each district were calculated from the 1981 livestock population estimates.

Sources: Central Bureau of Statistics (1983) Statistical Abstracts. Ministry of Economic Planning and Development: Nairobi. Annual Reports of the Animal Production Branch. MLD:Nairobi.

Priority programs in the high-potential area (Kitale) would be:

a) to continue to assemble, maintain, and evaluate grasses and legumes and any other forage crops suitable for use in the agro-ecological zones of western Kenya,

b) to continue investigations into the most suitable methods of propagating, managing, and utilizing forage grasses and legumes that can be used for the feeding of grade dairy cattle and other classes of livestock in zero-grazing management systems.

Of a lower priority at Kitale would be the continuation of forage breeding and ley pasture investigations. Forage breeding investigations should ultimately be terminated, as resources are not adequate for all types of pasture and forage research, and new varieties of forages can be imported from other breeding centers. With regard to ley pasture investigations, there is considerable information already available, and systems are changing, with ley pastures confined to the larger farms.

Program a) should be replicated at Naivasha (grasses and legumes suitable for natural pastures in ranching areas, Katumani (grasses, legumes, legume shrubs, and trees suitable for browzing and lopping in the dryland farming districts), and Mtwapa (grasses and legumes suitable for pastures in the high-rainfall coastal strip).

In dryland farming areas two other priority investigational programs are required:

c) investigation of the management and utilization of the most suitable grasses and legumes for natural pastures in the dryland farming districts,

d) study of the most suitable methods of propagating and utilizing legume bushes that can be browzed and legume trees that can be lopped in the dry season to provide livestock feed.

Priorities in Range Research

Major priorities in rangeland research would be:

a) investigation of the dynamics of livestock systems in all pastoral systems,

b) the development of possible drought strategies that could ultimately be used by GOK,

c) investigation of the effect of stress (feed and water shortages and trekking long distances) on the productivity of range livestock (cattle, camels, sheep, and goats),

d) investigation of the effect of grazing different proportions of range livestock together, with or without wildlife, on the productivity of the rangeland and the livestock.

Priorities in Veterinary Research

Priorities for veterinary research should be largely determined by the nature of the livestock production systems and the health constraints which they encounter. The objectives of livestock production were formulated in the National Livestock Development Policy and are summarized in the chapter on Animal Production Priorities and Programs. The policy was well-conceived and will remain appropriate for the next ten years. The aspirations of livestock producers are largely consistent with these policy objectives, but the increased production and productivity required to meet the policy objectives of self-sufficiency in livestock products will result in continuing adaptation of production systems. No revolutionary change is anticipated; rather, research must recognize that trends towards greater intensification and zero grazing in the high-potential areas and towards diversification of pastoral systems may have important animal health consequences.

A starting point in setting priorities for veterinary research is clearly to quantify the economic contribution made by species, breeds, and different classes of livestock in the whole range of production systems which exist today and also to anticipate how these contributions may change over the planning period.

The second stage is to examine our understanding of the health and production constraints operating in these systems, to quantify losses due to disease, and to examine which control measures exist and the costs and benefits of employing them. Where solutions exist which are of proven value in benefit-cost terms, research would only be justified if either greater disease challenge was anticipated or major improvements in technical efficiency were expected. In many cases solutions appropriate to local conditions do not exist. We must clearly distinguish between the availability of a prophylactic or therapeutic measure which works in the West European or North American environment and our ability to recommend systems for the use of the measure in the Kenyan environment. As a general principle it can be stated that research has already generated much knowledge relevant to the control of diseases in livestock but that more applied research is needed to convert this into practical, economic disease control systems. For a relatively minor group of disease problems no obvious control or treatment interventions are available and research may be required to identify these. Research requirements will also be generated by the emergence of new conditions, which continue today as management systems create new relationships between hosts and disease agents.

A third stage is to identify projects or research opportunities and to assess how likely a proposed piece of research is to generate knowledge which may be of practical use for the livestock producer. This is clearly a case for expert judgement, but there are some ground rules. It is important, for example, to judge not only if a project is likely to be successful in a technical sense, but also if the technology to be generated thereby is likely to be robust enough to be effective in the field. At this stage the decision will be affected by consideration of what type of research is appropriate at the present stage of development. Clearly, some research is highly speculative but, if successful, has a high return. This is often research demanding access to high levels of technology and a wide range of services. An extreme example here is the search, via genetic engineering techniques, for new vaccines against foot-and-mouth disease which would be more heat stable

and more effective. In this case the research is proceeding outside Kenya, but results would be of high applicability. There is clearly no need to duplicate this effort. The decision may be more difficult in less extreme cases, but the question "Is this being done elsewhere?" is always relevant.

Details of specific priority programs for veterinary research are provided in Volume II of the Report, major priorities can be stated:

Veterinary research must:

- Continue to evolve better methods for the prevention and control of major epidemic disease such as rinderpest and foot-and-mouth disease.

- Investigate and design appropriate methods for the control of diseases of major economic importance and of emerging importance such as the tick-borne diseases and parasitic gastro-enteritis.

- Design and test minimum packages of animal health inputs appropriate to the needs and financial resources of the small farmer.

Farming Systems Research

Introduction

In this research strategy and plan much attention has been given to the establishment of strong national and regional research centers. These centers should play an important role with regard to interactions between technical research, most of which is being carried out at the NRCs, and on-farm adaptive research, to be carried out at the NRCs, and on-farm adaptive research to be carried out by teams of farming systems researchers at the RRCs and in collaboration with the national extension service.

While the NRCs will be mainly involved in research for new materials and techniques that are technically feasible in the major agro-ecological and/or production zones, the RRCs should place emphasis on identifying materials and methods that are most relevant to the respective target groups of farmers in the region. The RRCs would thereby be in a position to give a feedback to the national commodity- or factor-oriented centers for the further orientation of their research activities.

In the past many of the so-called regional stations were too often regarded by the national stations as well-staffed testing sites. The regional stations were also quite willing to merely carry out technical experiments on behalf of the national stations.

More recently, farmers and officials have been putting pressure on the regional research stations to become more involved in the direct provision to farmers of relevant recommendations, technologies, and services.

In order to play this role properly, it has been considered appropriate to assign priorities and responsibilities to RRCs in farming systems research. Regional centers should, in collaboration with the extension service, follow careful procedures, including the identification of farmer target groups, diagnostic surveys, and on-farm

experimentation, and other methods which have already been introduced in the country since 1976 in programs constituting farming systems research. The details of the rationale for this approach are given in Volume II.

Proposed National Farming Systems Research Program

In the past 8 years a start has been made with introducing a farming systems perspective into crop and livestock research in Kenya, through the conduct of some diagnostic farm surveys, livestock systems studies, and through the formal in-service training of farming systems research specialists.

The National Extension Program made important contributions in recent years to a farmer-oriented approach in research, through the formalization of certain research-extension linkages, and through the introduction of on-farm trial networks.

The diagnostic farm surveys so far undertaken demonstrate interesting results of importance for adaptive research, but those studies were generally carried out on an ad hoc basis, and did not form part of a comprehensive regional or national program of on-farm research; the only exception being the regional activities undertaken by the Katumani National Dryland Research Station.

There is now a need for a country-wide adoption of the farming systems perspective in the agricultural research undertaken by the RRCs and in close collaboration with the national extension program. There would also be the need for coordination at the national level.

National coordination

Within the reorganized KARI, as proposed, the main responsibility for the coordination of farming systems research should rest with the Assistant Director RRCs, who should be assisted in this task by the Assistant Director Planning (economics) and the Assistant Director Animal Production (livestock systems).

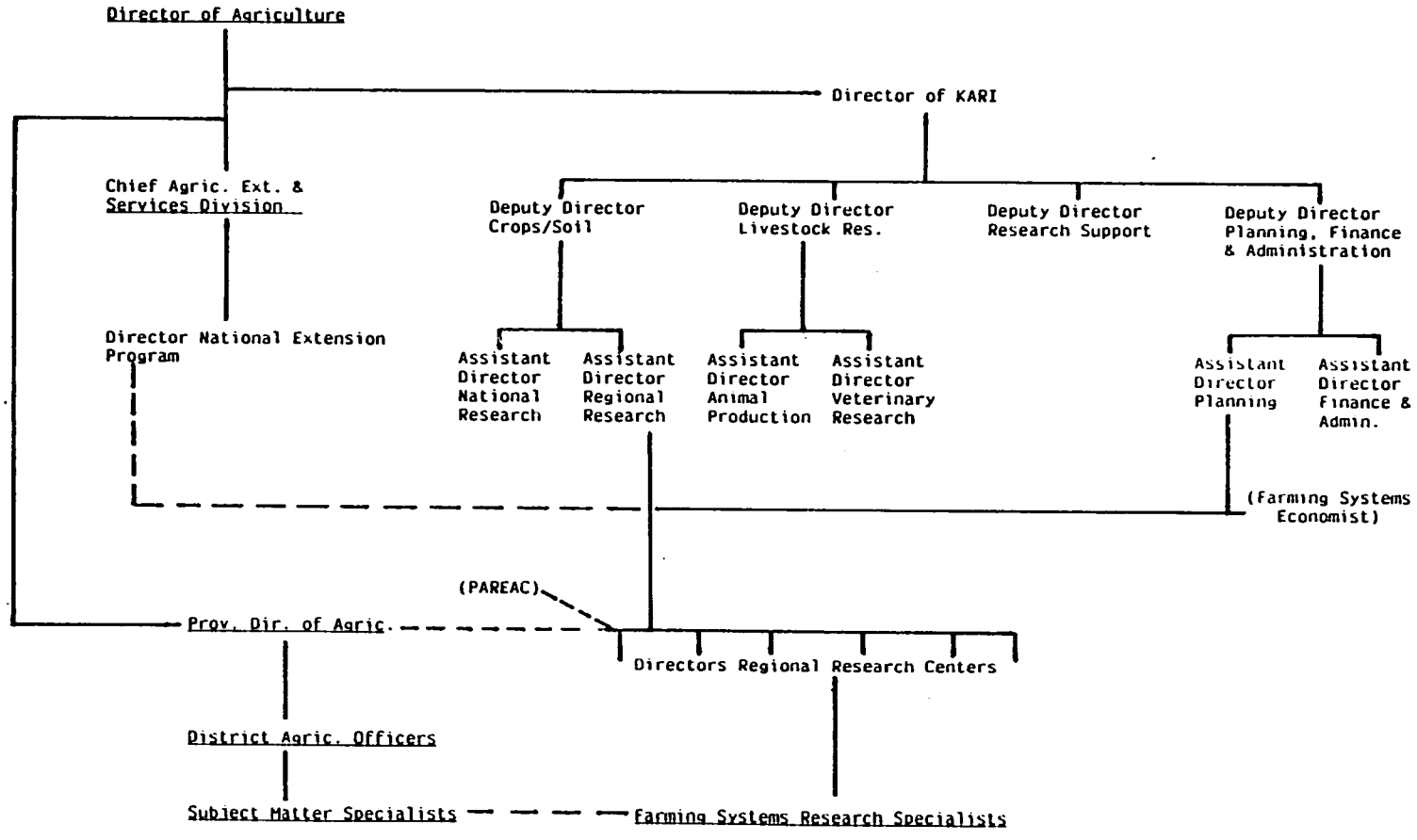
They should liaise closely with the Director of the National Extension Program (see Figure 2.1). Regular contacts should also be established with several branches within different divisions of the MOALD, such as the Agricultural Information Service and the Agricultural Credit and Farm Management Branches of the Agricultural Extension and Services Division, and the Agricultural Mechanisation, Soil and Water Conservation and Agroforestry Branches of the Land Development and Soil and Water Conservation Divisions.

It is proposed to recruit a Senior Farming Systems Economist with considerable experience in farming systems research and research-extension linkages to organize and assist in the coordination of farming systems research in the regions, and in the training of farming systems specialists (research officers and subject-matter specialists). He should liaise closely with CIMMYT's Eastern Africa Economics Program.

It should be the joint responsibility of the Assistant Director RRCs and the Senior Farming Systems Economist to:

a) identify training requirements and to organize training sessions for the farming systems research specialists;

Figure 2.1: Functional Relationships in the Coordination of Farming Systems Research



b) assist the RRCs with regard to methodological issues of on-farm research (determination of target groups; organization of diagnostic surveys and design of survey questionnaires; establishment and statistical analysis of on-farm trials);

c) assist the RRCs in the documentation of results from adaptive research and in the communication of these to the RRCs and the extension service;

d) organize seminars for high-level ministry staff and research staff from the NRCs;

e) initiate and coordinate socio-economic studies of crops livestock farming systems in the rangeland areas.

At the RRCs, farming systems research activities will be coordinated by the Directors of the RRCs, while policy matters will be handled by the Provincial Agricultural Research and Extension Advisory Committee(s).

Regional program and activities

An important part of the crop and livestock research activities of the regional research centers should be carried out on farmers' fields, and allowance for this, in terms of travel expenses, etc., should be made in the budget for the RRCs under the heading "farming systems research".

The regional on-farm research programs should have clearly defined procedures, including the identification of target groups, the diagnosis of farmers' circumstances, the design and management of on-farm experiments, the analysis of experimental results, and the presentation, through the extension service, of recommendations to farmers.

At each of the RRCs, it would be necessary to form one or more teams for on-farm research, generally composed of agronomists, soil scientists, farm economists, and livestock scientists. During the respective stages of the adaptive research cycle they will team up with crops, farm management, and/or other extension officers in the respective districts.

The details of recommended procedures and schedule of activities are given in Volume II. It should be pointed out that considerable infrastructural and logistic support would be required by the RRCs to carry out this program. This would include adequate housing, transportation, data processing facilities, and inputs and tools.

Forestry Research

Forestry research is currently undertaken mainly within the Forestry Research Department of KARI, Muguga; some forestry research is also undertaken in the Department of Forestry, Moi University, Eldoret. Before 1980, public-sector forestry research was based in a unit in the Forestry Department of the Ministry of Environment and Natural Resources. Forestry research has grown moderately and been strengthened in KARI through staff development and training, and moderate provision of improved facilities in the last 4 years, but major needs for staff training and specialization, infrastructural development, and program planning and diversification remain. The Mission in its discussions became aware of the moves to request the transfer of forestry research back to the Ministry of Environment and Natural Resources and its

constitution into a Forestry Research Institute closely related and responsible to that Ministry. In line with the rationale for the reorganization of KARI, Muguga, in this plan, and the established need for applied and adaptive research in the semi-autonomous research institutes created under the Act to relate closely to and serve the major users of their research products, the Mission endorses the idea of constituting the Forestry Research Department of the present KARI, Muguga, into a small semi-autonomous Forestry Research Institute of Kenya (FRIK) with similar functional relationships to the Ministry of Environment and Natural Resources as those recommended for the reorganized KARI and MOALD. This would require actions by the responsible Ministry in consultation with the NCST, MOALD, and the ministry responsible for economic planning to have such an institute created and gazetted as provided for in Section 12(2) of the Science and Technology Act 1979 (Chap. 250).

If, however, it is desired that forestry research should remain an integral part of the program at Muguga, then it would be necessary to specifically include forestry research in the mandate of Muguga, and perhaps to name it as a 'National Agricultural, Veterinary and Forestry Research Center', Muguga. Priorities and programs for forestry research provided in the 1981 Review of Kenya's Agricultural Research System (ISNAR R2) remain valid guidelines for the current needs of forestry research and are therefore not repeated in this strategy and plan. There is a great and continuing need to encourage and strengthen forestry research to meet the modern needs of Kenya in the areas of fuel wood, soil improvement and conservation, agro-forestry, and overall environment management.

Tea Research

Tea research is undertaken by the Tea Research Foundation, which was constituted into a foundation within the Ministry of Agriculture, with a new board of directors in 1980. Funding is through the Kenya Tea Board. Research to increase the production and quality of tea is undertaken by a small team of scientists and is focused properly on breeding, selection, plant nutrition, soil fertility, fertilization, water use and crop management. Efforts are being made, through technical and socio-economic studies, to improve the production and quality of tea from the smallholder farms, which now produce over 70% of the crop. Much of this work is carried out in collaboration with the Kenya Tea Development Authority (KTDA). Production has continued to increase steadily. There is evidence that yields are also increasing. Current research focuses on identification of the constraints and the direction of technical research to increase productivity. The foundation also has constraints of scientific manpower due to a rapid turnover of experienced staff. Its scientific career structure should enable it to attract and retain competent staff. No change in organization or focus is proposed.

Coffee Research

The Coffee Research Foundation is a parastatal research organization funded by the coffee industry. It is directed by a Board of Directors and is responsive to the problems of the small- and large-scale coffee growers. Research programs are mainly articulated by the scientists under the direction of the Board. Scientists maintain a close link with the industry, and a research liaison service serves to strengthen the links with the extension services of the Ministry of Agriculture and with

the farmer. Research focus is on agronomy, breeding, crop protection, crop physiology, and quality control. Major research achievements include breeding for resistance to coffee berry disease, the control of pests and diseases, and the management of the crop for increased productivity. An agricultural economics unit undertakes diagnostic and analytical farm surveys to guide research and the development and adoption of recommendations. An active research staff is engaged in well-coordinated research on this export crop. The staff was until recently relatively stable, and many of the present staff have been in the foundation for 5 or more years. This is no doubt associated with the suitable scientific career structure devised to reward scientific research merit and productivity -- unlike the structure in the ministries and other parts of the agricultural research system. Some constraints still exist in the areas of specialized manpower, in-service training facilities, and technical services, but the foundation should be able to overcome these if it continues to be funded adequately and if priority is given to these constraints in planning. No change in organization or responsibility is proposed.

The priorities for coffee and tea are briefly indicated under plantation crops (page 18).

## CHAPTER 3: MANPOWER DEVELOPMENT AND TRAINING

Lack of trained manpower for agricultural research continues to be one of the most important constraints in the planning, organization, and management of research in Kenya. The 1981 review of the system highlighted this constraint as perhaps the most crucial. The review report identified lack of adequate manpower and planned manpower development as major weaknesses in the system. Not only are the numbers of research scientists inadequate in relation to the priority and urgent problems of agricultural research and development, but a large proportion are inadequately, or not trained for research functions.

The review and subsequent manpower studies also found that out of a total of 566 research staff, only 192 had research-oriented training at the postgraduate level (M.Sc., equivalent diploma, or Ph.D.). The percentages of research-oriented trained staff were 14% for crop commodities, 23% for animal production and veterinary, and 22% for forestry. The total number of inexperienced staff was 374.

Since then the National Council for Science and Technology (NCST), the Ministries of Agriculture and Livestock Development, and the University of Nairobi have tried to address the problem in various ways. In 1982, a detailed analysis of manpower and training needs was undertaken, and a Training Plan was prepared with the assistance of ISNAR. This plan formed the basis of a 10-year Manpower Development and Training Proposal for the training of a total of 487 scientists and 148 research support staff and was estimated at a total cost of $15,530,000 over a period of 10 years. In addition, it provided for the strengthening of postgraduate research training at the University of Nairobi as a major contribution to in-country manpower development for agricultural research, at a cost of $9,646,300 over a period of 5 years. The total estimated investment considered necessary to upgrade the quality of research manpower in the total Kenyan agricultural research system was put at $25,176,300 over a period of 10 years. Kenya's contribution over the 10-year period was estimated at $15,119,153 (in 1984 dollars). This proposal is currently under serious consideration for submission to donors and other support agencies for funding. In the meantime, Kenya NARS has taken advantage of a few fellowships offered by Canada, U.K., USAID, Netherlands, etc. to cater for the most urgent training needs in specific areas. With continuing financial constraints, very limited success in training has been achieved at other levels of research and research support staff.

Rather than improving, the training needs situation has become more critical in the two intervening years since the preparation of the plan. The worsening situation is due, among other things, to:

(i) the recruitment of many more first-degree graduates in agriculture and science to research positions;

(ii) the loss of some trained and experienced research staff to the private sector;

Previous Page Blank

(iii) the apparent need to staff some substations and testing sites which have unwittingly been upgraded to research station status.

The major weaknesses of lack of adequate manpower and research-oriented training have therefore persisted. When combined with inadequate and erratic funding of research and the growing deterioration of the research infrastructure in stations and laboratories, the current and evolving situation could seriously damage the capacity of the research system to continue to contribute to agricultural development.

This chapter updates the information on previously assessed training needs and emphasizes again the urgency of a training program that would attempt to upgrade the research capability of existing staff and minimal additions, based on constrained demand estimations, in the period 1985-1995.

Table 3.1 summarizes the current employment position at Crops and Livestock Research Stations by main categories of research and research support personnel. With about 466 Research Officers and Senior Research Officers, 188 Technical Officers and Technologists, and 518 Technical Assistants and Laboratory Technicians, the ratio of 1:1.5 research staff to research support staff appears healthy. But a closer study of the distribution of staff shows great imbalance because of the concentration of research support staff at some stations; this imbalance should be corrected within the framework of rationalization of research stations. Further, many of the research support staff, although described as technicians, technical officers, or technologists, are in fact not adequately or specifically trained for the functions which they perform or are expected to perform. This emphasizes the need for additional training at formal local and overseas institutions for this category of staff. In addition, opportunities for training at relevant IARCs should be sought and taken to upgrade the training of these staff so as to improve their contribution and performance in research. It is recommended that instead of the 148 envisaged in previous training proposals, provision be made for about 300 of the 706 staff in these two categories (technical officer/technologists and technical assistants/technicians) to be trained over the next 10 years. Such training will involve on-the-job training, short courses locally and overseas, in-country technical training, seminars, workshops and contact visits, research and production training at IARCs, and field and laboratory management training. Details of these should be worked out at the level of the Deputy Director (Research Support) in the directorate of the reorganized KARI.

By far the most important and urgent manpower development and training requirement is for the scientific staff that will carry out the agricultural research strategy and plan conceived and presented in this report. Table 3.2 updates the status of research scientists in the research system by comparing the 1982 and 1984 data and presenting modest and realistic projections to 1994. The Mission considers that with the current state and status of research scientists and the projected responsibilities envisaged in sharpening the focus of research and strengthening the national capacity to carry out the planned programs and priorities, it should reaffirm the proposal made for manpower development and training in 1983. The proposal envisages the training of the necessary personnel over a period of 10 years and building a secure base

Table 3.1: Employment at Crops and Livestock Research Stations by Main Categories of Research and Research-Support Personnel

| Institution | | SROs/ROs | TOs & Technologists | TAs & LTs | Drivers & Artisans | Unskilled Staff | Total |
|---|---|---|---|---|---|---|---|
| Crops | | | | | | | |
| NARS | Kitale* | 39 | 17 | 60 | 34 | 169 | 319 |
| NHRS | Thika | 36 | 17 | 38 | 65 | 131 | 287 |
| NSRS | Kibos | 16 | 2 | 20 | 12 | 43 | 93 |
| NPBS | Njoro | 45 | 12 | 20 | 18 | 21 | 116 |
| NAL | Kabete | 106 | 16 | 27 | 47 | 102 | 298 |
| NPRS | Tigoni | 11 | 8 | 18 | 17 | 36 | 90 |
| NSQCS | Lanet | 21 | 21 | 33 | 59 | 61 | 195 |
| NDRS | Katumani | 29 | 11 | 37 | 39 | 124 | 240 |
| WARS | Kakamega | 12 | 3 | 24 | 11 | 54 | 104 |
| NARS | Kisii | 5 | 3 | 17 | 11 | 61 | 97 |
| PHRS | Molo* | 3 | 9 | 16 | 12 | 96 | 136 |
| ARS | Ol' Jor Orok | 3 | 3 | 11 | 12 | 39 | 68 |
| ARS | Embu | 6 | 5 | 13 | 13 | 53 | 90 |
| ARS | Mwea-Tebere | 15 | 5 | 23 | 15 | 26 | 84 |
| CARS | Mtwapa | 14 | 10 | 34 | 13 | 50 | 121 |
| CRS | Kibos | 9 | 4 | 20 | 7 | 18 | 58 |
| ARS | Alupe | 3 | 2 | 12 | 5 | 40 | 62 |
| ARS | Perkerra | 2 | 2 | 5 | 4 | 13 | 26 |
| ARS | Garissa | 2 | 4 | 7 | 2 | 3 | 18 |
| ARS | Matuga | 5 | 2 | 8 | 4 | 18 | 37 |
| ARS | Msabaha | 4 | 2 | 11 | 1 | 15 | 33 |
| ARD | Muguga | 23 | n.a. | n.a. | n.a. | n.a. | n.a. |
| Subtotal | | 439 | 158 | 454 | 401 | 1173 | 2572 |
| Livestock** | | | | | | | |
| AHRS | Kitale | 6 | | | | | 6 |
| | Naivasha | 20 | 7 | 28 | 14 | 257 | 326 |
| | Mariakani | 3 | 5 | 9 | 3 | 67 | 87 |
| | Kiboko | 17 | 10 | 11 | n.a. | n.a. | 38 |
| | Lanet | 5 | 5 | 11 | 11 | 34 | 66 |
| | Buchuma | 1 | 3 | 5 | 8 | 43 | 60 |
| APRD | Muguga | 5 | n.a. | n.a. | n.a. | n.a. | n.a. |
| Subtotal | | 57 | 30 | 64 | 36 | 401 | 583 |
| | TOTAL | 466 | 188 | 518 | 437 | 1574 | 3155 |

* includes pasture research scientists
** excludes veterinary research scientists
n.a. = not available.

Table 3.2: Current State and Status of Research Scientists in the National Agricultural Research System (1982 and 1984), With Projections to 1994

| Sector of Agricultural Research | No. of current staff | | No. of experienced* staff | | | | No. of inexperienced staff | | Net additions to 1994 |
|---|---|---|---|---|---|---|---|---|---|
| | | | 1982 | | 1984 | | | | |
| | 1982 | 1984 | Ph.D | M.Sc | Ph.D | M.Sc | 1982 | 1984 | |
| 1. Crop Commodities Research and Services | 385 | 420 | 53 | 53 | 58 | 50 | 279 | 296 | 80 |
| 2. Livestock Research (Animal Prod. Beef, Dairy, Sheep and Goats, etc.) | 65 | 67 | 12 | 13 | 14 | 15 | 40 | 58 | 61 |
| 3. Veterinary Research | 98 | 102 | 26 | 27 | 25 | 29 | 45 | 44 | 22 |
| 4. Forestry Research | 18 | 24 | 4 | 4 | 4 | 6 | 10 | 14 | 55 |
| TOTAL | 566 | 613 | 95 | 97 | 101 | 100 | 374 | 412 | 218 |

* Experienced research officer is defined as an individual with at least an M.Sc. degree and five or more years of experience.

for in-country manpower development and training. The Mission endorses the proposal that this should involve:

- assistance in the training of research scientists and support personnel through local and overseas fellowships and grants at different levels;

- the strengthening of relevant postgraduate programs at the University of Nairobi.

The latter would require the University of Nairobi to strengthen and diversify its postgraduate training program in agriculture and veterinary medicine, and to initiate or strengthen appropriate undergraduate programs in a limited number of areas, e.g. in animal production, horticulture, agricultural extension, and range management in order to meet complementary needs for research and training.

In consciously focusing on agricultural research as a priority area, it is appreciated that this proposal represents only a proportion of Kenya's overall manpower development needs in scientific, industrial and technological research. Kenya should continue to mobilize internal as well as external sources for the additional training of manpower to ensure balanced development.

The specific objectives of the proposal will be:

(a) to train, every year, about 60-63 research scientists who are currently in service, or will be recruited, but who lack research-oriented training to M.Sc. and Ph.D. levels;

(b) to expose, annually, about 30 serving research officers in the NARS to appropriate research or research support training at relevant IARCs;

(c) to train about 300 research support personnel in required techniques of research locally, overseas, and at IARCs;

(d) to encourage and assist the University of Nairobi in the strengthening of its postgraduate program in agriculture and veterinary medicine, and of appropriate undergraduate programs in animal production, crop science (horticulture), and range management;

(e) to support local field work on small-farmer/pastoralist-oriented research that would contribute to manpower development;

These objectives have been determined as appropriate after full consultation with all sectors of the national agricultural research system. They represent Kenya's full commitment to building a self-sustaining base for manpower development and training for a very important sector of the country's economy.

Two specific but inter-related projects can be derived from the proposal as follows:

(i) a Fellowships and Training Project;

(ii) a University of Nairobi Postgraduate Research Training Support Project;

It is suggested that these two projects be phased into an initial period of 5 years, followed by another period of 5 years, with 1985/86 as the starting year. It is realized that some further support would be required in these and subsequent years in order to stabilize manpower and training inputs in the national agricultural research system and fully integrate agricultural research education and other agricultural research endeavors into a highly productive system. The projects therefore should constitute an integral part of the overall efforts to strengthen the national agricultural research system.

Fellowships and Training Project

It is proposed that research scientists who are currently in service and the net additions based on estimated requirements up to 1994 should be trained in a manner compatible with the continued execution of viable research programs while the Fellowships and Training Project is in progress. This makes it necessary to suggest, as previously agreed, a realistic spread of the project over a period of 10 years, as shown below.

| | 1985 | '86 | '87 | '88 | '89 | '90 | '91 | '92 | '93 | '94 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| M.Sc. Univ. Nairobi | 22 | 22 | 25 | 28 | 30 | 32 | 32 | 36 | 39 | 38 | 304 |
| M.Sc. (Overseas) | 22 | 24 | 28 | 22 | 22 | 20 | 18 | 16 | 14 | 14 | 200 |
| Ph.D. Univ. Nairobi | 4 | 4 | 4 | 4 | 4 | 3 | 5 | 4 | 5 | 5 | 42 |
| Ph.D. (Overseas) | 10 | 10 | 10 | 10 | 8 | 8 | 8 | 8 | 6 | 6 | 84 |
| IARCs Research + other ad hoc short-term training | 30 | 36 | 42 | 48 | 40 | 38 | 30 | 16 | 10 | 10 | 300 |
| Total | 88 | 96 | 109 | 112 | 104 | 101 | 93 | 80 | 74 | 73 | 930 |

On the basis of these projections, a total of 504 M.Sc. and 126 Ph.D. fellowships will be required over a period of 10 years. Of these, 304 M.Sc. and 42 Ph.D. will be tenable at the University of Nairobi and 200 M.Sc. and 84 Ph.D. will be tenable at overseas institutions. Special provisions will be made for training in other developing countries' institutions as well as for course work overseas, followed by field research work in Kenya. This is in recognition of the contributions that such arrangements could make to overall national research efforts as well as to the relevance of the training program.

A total of 300 short-term research training fellowships, mainly for research support technicians, will also be required to enable that number of persons to participate in research training at IARCs and other institutions that have strong, relevant programs in the crops, commodities, or systems of importance and interest to Kenya. IARCs such as ILRAD, ILCA, IITA, CIMMYT, CIAT, CIP, and ICRISAT will be approached to assist in such research training. It is also proposed that some additional provision be made for on-the-job training of research support personnel and for support to research scientists in post or in training to participate in seminars, conferences, and workshops that have educational and training value.

In the event of a severe shortfall during the mobilization of internal and external resources for these proposed manpower development and training projects, the minimum requirement will be to provide training for existing serving research officers who have had no formal research training at the postgraduate level. Out of a total of 586 current staff in Crop Commodities Research and Services, Livestock, Veterinary, and Forestry Research, 412 are regarded as 'inexperienced' or inadequately trained for research. As a minimum, these 412 officers will have to be trained over the next 10 years to provide the minimum base of trained research personnel for the system to fully function and be productive. The minimum training requirements, without expansion, would therefore entail an average of 41 fellowships per year and can be appropriately phased over a 10-year period.

In addition to these, about 150 short-term, in-service research training fellowships (average of 15 per year) at IARCs and other relevant training institutions will be required to strengthen the expertise of serving research officers and research support technicians. This represents a fall-back position which should be avoided if possible.

Details of the disciplines and areas of research training are not given here, but they will approximate the requirements envisaged in the Manpower Training Plan. Provisions will be made through the Training Office in the MOALD to review on an annual basis the areas in which candidates will be trained and the distribution of such trainees among the research centers constituting the national agricultural research system.

University of Nairobi Postgraduate Research Training Support Project (1984-1988)

The purpose of this Project will be to assist in the building of an in-country capacity for the training of agricultural research scientists in the priority areas of need in Kenya. The University of Nairobi already has postgraduate programs in agriculture and veterinary medicine, but it is felt that these require strengthening and diversification to enable them to improve on the numbers of intake, supervisory capacity, and the quality and orientation of the training programs. Some external assistance will therefore be required to strengthen the M.Sc. programs and initiate or strengthen Ph.D. programs in some important areas at least until 1990. This would further bring the University of Nairobi into the mainstream of agricultural research and development.

The Mission endorses the requirements for strengthening as determined by a joint ISNAR/University of Nairobi study team to include:*

(a) provision of senior academic staff to assist in postgraduate teaching, supervision, and curriculum development for about five years;

(b) training of potential staff members in specific areas of shortage of expertise and/or experience;

(c) infrastructural support in terms of a multipurpose postgraduate building, a research library building, books, journals, and periodicals;

(d) teaching and research equipment;

(e) provision of research funds to support research station and on-farm research (farming/pastoral systems) of postgraduate students and their academic or research staff directors and collaborators;

(f) provision of some short-term fellowships for training of research support staff and technicians;

There also appears to be a need for initiating or increasing the assistance to specific undergraduate programs such as in animal production, agro-meteorology, and range management. The need here will be mainly in terms of items (a), (b), (c), and (d) above, and would involve cooperation with other departments in the University.

It is believed that a possible appropriate mechanism for achieving the strengthening of the postgraduate programs and the identified undergraduate programs, in the faculties of Agriculture and Veterinary Medicine (now College of Agriculture and Veterinary Medicine), University of Nairobi, as had been tried on a limited scale before, will be to link these faculties with some appropriate faculties in universities or a consortium of universities in some countries (e.g. Canada, the United States, United Kingdom, Australia, Germany, or Netherlands) where strong programs already exist.

---

* ISNAR/University of Nairobi Report on Requirements for Strengthening Postgraduate Research Training in Agriculture and Veterinary Medicine, 1983.

The broad outlines of the requirements for this Project, as assessed by a joint ISNAR/University of Nairobi study team, with an external consultant from the University of London, are presented in Table 3.3.

It must be emphasized that these requirements are critical for the proper evolution and development of strong and productive postgraduate and undergraduate programs in the relevant areas. The support envisaged has been carefully worked out in consultation with the University of Nairobi and has been related to the University's capacity to contribute to Manpower Development and Training in the first project and to the requirement to strengthen its own capacity to support, on a self-sustaining basis, manpower, training, and research inputs into Kenya's overall national agricultural research system. It is recognized that some essential benefits will also accrue from this project to other developments in the field of university agricultural education and research in Kenya. The Project may also be spread over a period of 10 years, instead of five, if this is considered desirable as a result of institutional capacity or resources availability.

Training in Research Management

Agricultural research managers in Kenya, as in many other developing countries, have come through the ranks over a relatively short period and have had no formal training in the management of research. As research objectives become more sharply focused and productivity demands become more urgent, the managers in the research system must be able to apply appropriate research management techniques and practices to ensure relevance and productivity. Management expertise will be required in this context by directors of centers, project coordinators, project leaders, research administrators, and station managers. It is therefore recommended that in order to build management expertise into the research system in Kenya, a consistent program of training of these categories of staff be embarked upon in the next five years. This could be achieved by utilizing opportunities for regional and international training in agricultural research management and by developing in-country training in agricultural research management. Such training should be covered in part by the provision for seminars and workshops in Project I in Table 3.4.

Manpower Development and Training Costs

The cost estimates of the manpower development and training projects in the two categories of local and overseas fellowships training and postgraduate research training support are presented in Table 3.4. These estimates now stand at about $30 million over 10 years and have provided for increased costs at the rate of 6% per year over the projects' period. These costs would need to be reviewed on an annual basis over the period. The Mission believes that the benefits of such a massive investment in manpower development and training will justify the cost. Kenya cannot expect to obtain increased productivity from its research personnel unless they are adequately trained and fully supported to execute well-planned agricultural research strategy and programs.

Table 3.3: Estimated Costs of Requirements for the University of Nairobi Postgraduate Research Training Support

| Requirements | Faculty of Agric. (as a whole) | Faculty of Veterinary Medicine | Special Assistance to Animal Prod. and Range Management | Special Assistance to Forestry | Total in Nos. and/ or 1984$ |
|---|---|---|---|---|---|
| 1.Senior Acad. Staff Assistance (Nos.) | 20 | 10 | 12 | 8 | 50 ($3,000,000) |
| 2. Staff Development Fellowships (Nos.) | 24 | 10 | 10 | 8 | 52 ($2,160,000) |
| 3. Infrastructural support-postgraduate Buildings (laboratories, tutorial and seminar rooms, etc.) (US$'000) | | (Both Faculties $924,000) | | | $924,000 |
| 4. Teaching and research equipment (US$'000) | | (Both Faculties $1,625,000) | | | $1,625,000 |
| 5. Research-support funds (US$'000) | | (Both Faculties $850,000) | | | $850,000 |
| 6. Library building, equipment and books (US$'000) | | (Both Faculties $370,000) | | | $370,000 |
| 7. Short-term special training fellowships (Nos.) | 20 | 20 | 5 | 5 | 50 ($300,000) |
| | | | | | $9,229,000 |
| Provision for cost increase over five years | | | | | $ 417,300 |
| | | | | | $9,646,300 |

Table 3.4: Provisional Cost Estimates of Kenya's Manpower Development & Training Projects
(All Costs in 1984 $)

Project I - Fellowships and Training Project

| | Costs per fellow-ship year $ | Nos. | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Cost Projections per year (1985-94) in $ '000 | | | | | | | | | | |
| 1. M.Sc. Fellowships (Univ. of Nairobi) | 8000 | 304 | 176 | 352 | 376 | 424 | 464 | 496 | 512 | 544 | 600 | 616 | 4560 |
| 2. M.Sc. Fellowships (Overseas) | 20000 | 200 | 440 | 920 | 1040 | 1000 | 880 | 840 | 760 | 680 | 600 | 560 | 7720 |
| 3. Ph.D. Fellowships (Univ. of Nairobi) | 8000 | 42 | 32 | 64 | 96 | 96 | 96 | 88 | 96 | 96 | 112 | 112 | 888 |
| 4. Ph.D. Fellowships (Overseas) | 20000 | 84 | 200 | 400 | 600 | 600 | 560 | 520 | 480 | 480 | 400 | 400 | 4640 |
| 5. IARCs and Research Support Training Fellowships | 7000 | 300 | 105 | 126 | 147 | 168 | 140 | 133 | 105 | 56 | 35 | 35 | 1050 |
| 6. Seminars, Conferences, Workshops | - | - | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 200 |
| Subtotal | | 930 | 973 | 1882 | 2279 | 2308 | 2160 | 2097 | 1973 | 1876 | 1767 | 1743 | 19058 |
| Provision for increased costs per year | | | - | 112.9 | 136.7 | 138.5 | 129.6 | 125.8 | 118.4 | 112.6 | 106.0 | 104.6 | 1143.5 |
| Total | | | 973 | 1994.9 | 2415.7 | 2446.5 | 2289.6 | 2222.8 | 2091.4 | 1988.6 | 1873 | 1847.6 | 20201.5 |

Project II - University of Nairobi Postgraduate Research Training Support Project

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 7. Multipurpose Postgrad. Building | - | - | 462 | 462 | - | - | - | | | | | | 924 |
| 8. Visiting Senior Academic Staff | - | 50* | 600 | 600 | 600 | 600 | 600 | | | | | | 3000 |
| 9. Staff Development Fellowships | - | 52 | 572 | 572 | 456 | 332 | 228 | | | | | | 2160 |
| 10. Teaching and Research Equipment | - | - | 325 | 325 | 325 | 325 | 325 | | | | | | 1625 |
| 11. Postgraduate Research Library | - | - | 85 | 85 | - | - | | | | | | | 170 |
| 12. Library equipment, books, etc. | - | - | - | 100 | 100 | - | - | | | | | | 200 |
| 13. Research Support Funds | - | - | 170 | 170 | 170 | 170 | 170 | | | | | | 850 |
| 14. Short-term special fellowships in research techniques | - | 50 | 60 | 60 | 60 | 60 | 60 | | | | | | 300 |
| Subtotal | - | | 2274 | 2374 | 1711 | 1487 | 1383 | | | | | | 9229 |
| Provision for increased costs at 6% per year | | | - | 142.4 | 102.7 | 89.2 | | 83 | | | | | 417.3 |
| Total | | | 2274 | 2516.4 | 1813.7 | 1576.2 | 1466 | | | | | | 9646.3 |
| Grand Total (Projects I and II) | | | | | | | | | | | | | 29847.8 |

* Person years.

Scheme of Service

Manpower development and training, while being an important component of personnel development and utilization, is not the only solution to the problem of research productivity. Trained manpower must be appropriately deployed in relation to research problems and the location of problem-solving research activities. Trained manpower must also be adequately supported to carry out approved priority research programs that would have a progressive impact on agricultural productivity. ISNAR's 1981 report on Kenya's NARS refers to the need for a conducive 'research environment', including adequate remuneration, recognition of research services, and the provision of facilities and overall environment for effective performance.

The Mission understood that a harmonized Scheme of Service, including remuneration, allowances, and other conditions, has been proposed to Government for all staff in Research Institutes, as shown in Annex VI.

The Mission endorses the proposal as a promising mechanism for ensuring that trained staff are retained in productive research and an indication that concern will grow to continually improve the overall research environment for the productive agricultural research scientist.

# CHAPTER 4: RATIONALIZATION OF THE NETWORK OF RESEARCH STATIONS AND INSTITUTIONS

## 4.1 Research Stations Network

The network of agricultural research stations and institutions has evolved since the beginning of this century partly in response to needs as perceived by the government and the farming community and partly for historical reasons. From a group of four agricultural research institutions and laboratories established in the first three decades: National Agricultural Laboratories (NAL); Coffee Research Foundation (CRF); Veterinary Research, Kabete; Plant Breeding, Njoro; to introduce, test, and promote the production of new crops and animals and provide for animal health research and services, the network has now grown to a total of 46 national and regional stations, substations, and testing sites (see Table 4.1). The most extensive development of research stations occurred in the 1940s and '50s, and research was strengthened by the development of regional research activities, such as in East African Agriculture and Forestry Research Organization (EAAFRO) and East African Veterinary Research Organization (EAVRO).

The phenomenal increase in the number of research stations in recent times has not entirely been due to agro-ecological diversity or need. In some cases stations have evolved from testing sites or purely as means of retaining assigned land or creating a government agricultural presence in an area. These have led, as we observed, to a proliferation resulting in the extension of agricultural research resources over a large number of stations, some of which are hardly viable. The rationalization of this network, in accordance with government request, is therefore a priority, if the system is to function effectively and be productive.

The Mission, while recognizing the need for adequate response by government agricultural research establishments to the needs of farming communities throughout the country, the need for retaining valuable land, and sometimes the need to create, and be seen to create, government agricultural research presence in the rural areas, feels that fairly strict criteria should be applied in the rationalization of the research station network. The Mission has therefore applied the following overriding criteria in rationalizing the research stations network:

(i) ecological diversity - Each broad agro-ecological zone within the country should have a research station to serve it in generating and adapting improved technologies for the production systems in that zone. Where there is a high degree of heterogeneity in agro-ecological conditions (sub-agroecological zones) or production systems, there may be the need to have one or more substations to take care of such diversities.

(ii) priority importance of crop or commodity - The most important commodities of the country in the food, export, or agro-industrial areas, should each have a research station working on the generation and testing of improved technologies for increasing productivity. The importance of a crop or commodity is based on its total value, quantities produced,

Table 4.1: List of Current National and Regional Research Stations and Substations (1984)

| | Stations | Substations/Testing Sites |
|---|---|---|
| 1. | National Agricultural Laboratories, Nairobi | |
| 2. | National Agricultural Research Station, Kitale | (i) Ol' Jor Orok<br>(ii) Marindas |
| 3. | National Plant Breeding Research Station, Njoro | |
| 4. | National Horticultural Research Station, Thika | (i) Tigoni<br>(ii) Njabini<br>(iii) Gituamba |
| 5. | National Sugar Research Station, Kibos | (i) Mtwapa<br>(ii) Opapo<br>(iii) Mumias |
| 6. | National Dryland Farming Research Station, Katumani | (i) Kampi-ya-mawe<br>(ii) Kitui<br>(iii) Perkerra |
| 7. | National Pyrethrum & Horticultural Research Station, Molo | (i) Perkerra<br>(ii) Marindas |
| 8. | National Potato Research Station, Tigoni | (i) Molo |
| 9. | National Seed Quality Control Service, Lanet | (i) Kitale |
| 10. | National Animal Husbandry Research Station, Naivasha | (i) Kitale<br>(ii) Ol' Jor Orok<br>(iii) Kiboko<br>(v) Mariakani |
| 11. | National Range Research Station, Kiboko | (i) Buchuma<br>(ii) Garissa<br>(iii) Marsabit |
| 12. | Western Agricultural Research Station, Kakamega | (i) Alupe<br>(ii) Lanet |
| 13. | Coastal Agricultural Research Station, Mtwapa | (i) Msabaha<br>(ii) Matuga<br>(iii) Mariakani<br>(iv) Lamu<br>(v) Taita-taveta<br>(vi) Kwale |

Table 4.1 continued

| | Stations | Substations/Testing Sites |
|---|---|---|
| 14. | Nyanza Agricultural Research Station, Kisii | - |
| 15. | Central Agricultural Research Station, Embu | (i) Murinduko<br>(ii) Katumani |
| 16. | Cotton Research Station, Kibos | - |
| 17. | Agricultural Research Station, Mwea-Tebere | - |
| 18. | Beef Research Station, Lanet | - |
| 19. | Agricultural Research Station, Garissa | - |
| 20. | National Irrigation Board, Ahero | - |
| 21. | National Veterinary Research Laboratories, Kabete | Embakasi, Eldoret, Karatina, Kericho, Mariakani, Nakuru. |
| 22.* | Kenya Agricultural Research Institute, Muguga | |
| 23.* | Irrigation Research Station, Hola | |
| 24.* | Coffee Research Foundation, Ruiru | |
| 25.* | Tea Research Foundation, Kericho | |

* Not associated with SRD, Ministry of Agriculture and Livestock Development.

monetary value, areas of production, and population affected (see chapter on Research Priorities and Programs); also importance as a food, export, or agro-industrial commodity, e.g. maize, coffee, cotton.

(iii) priority importance of a factor of production - The most important factors of production in the country should have research concentrated on them so as to generate technologies that would ensure the most efficient utilization of those factors and their conservation as necessary, e.g. soils and water (Soil/Water Management).

(iv) development of laboratory research and research-related services - Certain research activities and research-related services which require laboratory facilities, e.g. soil chemistry, plant and animal virology, immunology, epidemiology, taxonomy, and identification of insects and pathogens. Biochemistry and pathology would need to be developed or strengthened at certain stations.

(v) the need for lead role in certain commodities or systems - Other commodities or systems not otherwise provided for require research inputs through the assignment of lead roles to stations whose focuses are regional or national in the generation, adaptation, and testing of technologies.

(iv) special circumstances - There may be the need to initiate research activities in areas necessary for exploring future potential and possibilities, e.g. irrigation and drainage.

Given these considerations, the Mission agreed to recommend two main types of research centers:

(i) National Research Centers;
(ii) Regional Research Centers.
(Note that the Mission is proposing the use of 'centers' instead of 'stations' in order to emphasize the size, comprehensiveness and scale of responsibilities of these 'centers'. The 'centers' are to be seen as strong centers for multidisciplinary research, with strong scientific leaderships and some degree of flexibility and semi-autonomy in the execution of their research programs once the research priorities and programs are determined and approved).

## 4.2 National Research Centers (NRCs)

It is proposed that there should be a limited number of NRCs determined strictly by the priority status of the commodity or problem to be addressed (first priority). An NRC would be expected to be the principal research organ for generating and testing improved technologies. in a commodity, limited range of commodities, or in a factor of production, e.g. maize, wheat, and oilseeds, Soil/Water Management. It would build up a multidisciplinary team of breeders, agronomists, horticulturists, soil scientists, entomologists, plant pathologists, socio-economists, etc. in relation to the scale of the production and productivity problems to be addressed, and its program would be sharply focused on generating technologies that can be widely adopted in the commodity or problem area. There will be variations in size and

composition of staff, but these will be determined by the need and focus of the programs. A total of 13 such NRCs are recommended, covering the first-priority crop commodities, factors, and livestock. The details are presented in Table 4.2.

4.3 Regional Research Centers (RRCs)

It is proposed that there should be six RRCs. The number of RRCs is determined by the number of broad agro-ecological zones of the country that can be efficiently served by critical masses of scientists working together in teams (Figure 4.2). An RRC would be expected to be the principal research organ for assisting in the determination of research production problems in each agro-ecological zone, adapting technologies for increasing productivity at the farm level, and interacting with the extension service and farmers in on-farm research and testing of improved technologies. The teams in RRCs would also be multidisciplinary, with a strong focus on adaptive and problem-solving research and would comprise scientists in similar disciplines to those indicated under NRCs but also including animal production and animal health scientists and other subject-matter specialists. They would be largely systems-oriented, with emphasis on improving the productivity of the production systems in the zone. RRCs would be expected to play specific roles in interaction with farmers' training centers and in the training of extension personnel in the improved crop and animal production and management technologies. As far as possible, an RRC would cover a group of districts and would thereby reflect the district focus emphasis in the government development strategy (Annex III).

The Mission recommends that there should be no distinction in status between NRCs and RRCs; the only difference being that of focus. RRCs would also require strong leadership and flexibility in their operations. Generally only RRCs may have subcenters, depending upon the range and diversity of the area to be served. It is imperative that RRCs should not serve as substations for NRCs and vice versa. Both types of centers will have clear and specific mandates, and research coordination may be at the NRCs or RRCs, with both types serving as cooperating centers. (See Chapter 5).

In addition, RRCs may be given lead roles in commodities, crops, or systems to which a slightly lower degree of priority is assigned on the basis of the established criteria for research program priorities determination.

The details of the RRCs recommended, the districts covered, the crops identified in the systems, and the subcenters, where appropriate, are indicated in Table 4.2.

Apart from NRCs and RRCs, it is recommended that other research activities be undertaken at subcenters as indicated, or at experimental sites to be determined, both subcenters and experimental sites should be staffed by Technical Officers or experienced Technical Assistants able to lay out, supervise and record data on experimental work and make other relevant observations. The list of subcenters, some of which substitute for present stations or substations, are also shown in Table 4.2. Generally no subcenters are envisaged for NRCs, but NRCs will cooperate with all RRCs in matters relevant to their mandates.

In summary, the Mission recommends that the existing network be rationalized into 13 NRCs, and six RRCs. The remainder of the network should be maintained only as subcenters and/or experimental sites (ES) as indicated. It is suggested that any increases on these numbers should be made only after strict consideration of the criteria established and discussed above and in the section on 'Research Priorities', and with due regard to the availability of additional resources for the system.

It is also recommended that the National Sugar Research Center should be constituted into a Sugar Research Foundation based on the model of the Tea and Coffee Research Foundations and supported and financed by the sugar industry. If this is done, the number of NRCs will be 12 instead of 13.

4.4 National Irrigation and Drainage Research Center

In the rationalization of the network of research stations provided above, only one new national research center is proposed - the National Irrigation and Drainage Research Center (NIDRC). This proposal is to enable Kenya to tap the vast and underutilized potential resources of the Lake Basin Area, the Tana River Basin and the Yala swamps, etc., and to progressively expand agricultural production areas from irrigated and drained lands, including the salt-affected and other difficult soils. The full rationale for the creation of NIDRC is provided in the chapter on Soil/Water Management in Vol. II.

It is proposed that the new research center be located at Ahero or Garissa in the midst of a vast irrigation and drainage area for agricultural production. It is appreciated that Garissa may be a difficult location from the point of view of infrastructure and accessibility. In view of this, it is recommended that Ahero should be considered as the first location, with Garissa as an alternative. This would involve MOALD negotiating with the National Irrigation Board to have the Ahero facility transferred and developed as the nucleus of the new National Irrigation and Drainage Center. Location in Ahero would facilitate concentrated work on the development and testing of irrigation and drainage technologies in collaboration with the Lake Basin Authority. In this circumstance, a sub-center will have to be developed at Garissa.

The Mission considers this proposal a priority proposal and one in which at least a modest beginning should be made in the next five years.

4.5 Pyrethrum Research

Although the export earnings from pyrethrum have fluctuated widely in recent times, it continues to be an important export crop for Kenya. Pyrethrum seems to have retained its importance despite the development of synthetic pyrethroids and their applications. Kenya maintains a modest research effort based on the Molo Research Station, which has not been included in the reorganized network of research centers. Again the case of pyrethrum appears to be similar to that of tea. It is a crop where a small research unit can most efficiently function in very close relationship to the production, processing, and export industry. It would seem appropriate for the priority and programs for pyrethrum to focus on the improvement of the crop, improved agronomic services to farmers, and post-harvest and processing technologies. These programs can be carried out by a small research foundation or unit, similar to the TRF, related to and funded by the Pyrethrum Board. It is therefore

Table 4.2: Rationalization of the Research Station/Institutes Network:

Recommended National Research Centers (NRCs), Regional Research Centers (RRCs), and Subcenters (SC)

| NAME | AGRO-ECOLOGICAL ZONE | CROP/COMMODITY/ FACTOR | DISTRICTS | SUBCENTERS | EXPERIMENTAL SITES | COOPERATING CENTERS |
|---|---|---|---|---|---|---|
| A. NATIONAL RESEARCH CENTERS (NRCs) | | | | | | |
| 1. National Maize & Pastures Research Center, Kitale | Sub-Humid to Humid | Maize (major) Pastures (minor) | All maize-growing districts | - | To be determined | Mtwapa Kakamega Embu Katumani |
| *2. National Wheat & Oilseeds Research Center, Njoro | Semi-Humid/ Sub-Humid | Wheat (major) Oilseeds (major) | All wheat and oilseeds-growing districts. Also Nakuru, Laikipia, Narok, Uasin Gishu (for RRC functions) | - | " | Mwea-Tebere Katumani Mtwapa Kakamega |
| 3. National Horticultural Research Center, Thika | Semi-Humid | Horticultural crops (major) Fruits, Vegetables, Beans | All horticultural crops growing districts | - | " | Kakamega Mtwapa Kitale Tigoni |
| 4. National Potato Research Center, Tigoni | Semi-Humid/ Sub-Humid | Potato (major) Floriculture | All potato growing districts | - | " | |
| 5. National Agricultural Research Center, Muguga | Semi-Humid to Semi-Arid | Animal Nutrition & Physiology, Vet. Research, Plant Introduction/ Quarantine, Agricultural Engineering | All districts | - | " | All RRCs |
| *6. National Dryland Farming Research Center, Katumani (including soil/water management) | Semi-Arid to Arid | Soil/Water Management (major) Crop/Livestock improv. | All districts. Also Machakos, Kitui, Kaijado (for RRC functions) | Perkerra Kitui Kampi-ya-mawe | | |

Table 4.2 continued

| NAME | AGRO-ECOLOGICAL ZONE | CROP/COMMODITY/ FACTOR | DISTRICTS | SUBCENTERS | EXPERIMENTAL SITES | COOPERATING CENTERS |
|---|---|---|---|---|---|---|
| A. NATIONAL RESEARCH CENTERS (NRCs) (continued) | | | | | | |
| 7. National Agricultural Research Laboratories, Nairobi | Semi-Humid/ Semi-Arid | Soil Chemistry and Soil Fertility, Soil Survey and Land capability, Post-harvest technology, Taxonomy, Insect & Pathogen survey Identification (including viruses) Pesticide analysis | All districts | - | " | All RRCs |
| 8. National Animal Production Research Center, Naivasha | Semi-Humid/ Semi-Arid | Animal Production Dairy Beef cattle, Pigs, Poultry | All animal production districts | Mariakani (RRCs) Ol' Jor Orok Molo | Lanet | Kakamega Kibos Embu Katumani Mtwapa |
| 9. National Range Research Center, Kiboko | Semi-Arid/Arid | Range Management Research, Climatology, Socio-economics | All range animal prod. districts | **KALRS, Marsabit Buchuma | " | Garissa |
| 10. National Veterinary Research Laboratories | Semi-Humid/ Semi-Arid | Veterinary Research & research-related services | All districts | - | " | |
| 11. National Seed Quality Research Center, Lanet | Semi-Humid | Seed Research & Technology, Seed research-related services | All districts | - | " | Kitale Thika |
| ***12. National Sugar Research Center, Kibos | Sub-Humid/Humid | Sugarcane | All sugarcane growing districts | - | " | |
| 13. National Irrigation and Drainage Research Center, Ahero/Garrissa | Arid to Very Arid | Irrigation and Drainage | All irrigated districts | Garissa/Ahero | " | Katumani |

(All NRCs will have small on-farm/farming systems research units cooperating with relevant RRCs).

Table 4.2 continued

| NAME | AGRO-ECOLOGICAL ZONE | CROP/COMMODITY/ FACTOR | DISTRICTS | SUBCENTERS | EXPERIMENTAL SITES | COOPERATING CENTERS |
|---|---|---|---|---|---|---|
| B. REGIONAL RESEARCH CENTERS (RRCs) | | | | | | |
| 1. Regional Research Center, Embu | Semi-Humid to Semi-Arid | Maize, Beans, Pineapple, Rice, Cotton, Livestock Farming Systems | Embu, Meru, Muranga, Kiambu Nyeri, Kiringaya | | * | All NRCs |
| 2. Regional Research Center, Mwea-Tebere | | Cotton, Rice | Muranga, Meru | Kibos | * | All NRCs |
| 3. Regional Research Center, Mtwapa | Humid (coastal)/ Sub-Humid | Cashew, Coconut, Maize, Cassava, Cowpea, Sesame, Dairy Farming | Kilifi, Lamu, Tana River, Kwale, Taita Taveta | Matuga, Mariakani | Msabaha | * |
| 4. Regional Research Center, Kakamega | Humid to Sub-Humid | Maize, Beans, Sunflower, Cotton, Livestock, Farming Systems Fruits and Vegetables Sorghum, Millet | Kakamega, Bungoma Nandi, Busia, Siaya, Turkana, Trans Nzoia | | Alupe | * |
| 5. Regional Research Center, Kisii | Sub-Humid/ Humid | Sorghum, Maize, Groundnut, Cotton, Sugarcane, Rainfed Rice, Cassava, Livestock Farming Systems | Kisumu, Kisii South Nyanza, Kericho | Kericho | * | * |
| 6. Regional Research Station, Garissa | Semi-Arid/ Arid | Rice, Vegetables, Cotton | Garissa, Wajir, Isiolo, Marsabit, Mandera | | * | * |

* Njoro and Katumani will also have strong RRC-type research programs in technology adaptation, and on-farm research with a farming systems perspective.

** KALRS - Kenya Arid Lands Research Station.

*** Preferably to be constituted into the Sugar Research Foundation supported by the Sugar Industry.

recommended that MOALD should transfer the Molo Research Station to the Pyrethrum Board and ensure that the Board sets up a small research unit made up principally of agronomists, breeders, and postharvest technologists to continue the essential work in pyrethrum research.

4.6 Mandates of Research Centers

The study and analysis of the information provided to the Mission during the visits to the research stations, in the questionnaires prepared by stations, and in the briefing document by MOALD show conclusively that no clear and specific mandates have been established for research stations or substations in the existing network. In most cases mandates or objectives have been evolved by research staff in the general areas of the problem or commodities with which the stations are associated. At best, the assumed mandate is rather diffuse and often represents the general or specific interest of the investigators. Often there is also no congruence between the mandates recognized by the headquarters and those indicated or pursued by the research station management and staff.

The Mission feels that in order to have a coherent national research strategy and program there is a great and urgent need for the specification of mandates for the recommended national and regional research centers. The organization and coordination of research programs, and the mandates of research centers are further developed in Chapter 5. The recommended specific mandates for the national and regional research centers are given in Annex IV to this report.

## CHAPTER 5: ORGANIZATION AND COORDINATION OF RESEARCH PROGRAMS

The rationalization of agricultural research stations discussed earlier leads to the setting up of two types of research centers - National Research Centers and Regional Research Centers, with clearly defined mandates and responsibilities. While this model is considered most appropriate for Kenya, it should be stressed that the individual centers by themselves cannot achieve much, unless they are knit together in a highly coordinated network with free flow of materials, information, and ideas and with a great deal of collaborative work. The national centers, whose mandates transcend agro-ecological barriers, cannot generate technology for the whole country based on their work at a single location. They obviously need to carry out some of their research work in other agro-ecological zones. For this reason, it may be necessary for them to undertake research activities in different parts of the country. The Mission feels that in the context of Kenya this would be neither cost effective nor would it be desirable from a scientific point of view. The Mission therefore strongly recommends that the NRCs should organize collaborative research programs with the RRCs to achieve wider agro-ecological coverage. This does not mean that the RRCs would be subordinate to the NRCs, as many of them appear to be at present. Rather, the suggestion is that RRCs should join hands as equal partners in collaborative research with the NRCs in a series of nationally coordinated programs. This will help to achieve some important objectives. First, the RRCs will have a sense of involvement in carrying out research which answers the needs of farmers in their parts of the country, and in this way generate greater confidence in the technology which they recommend to farmers. Second, the programs will help to improve the scientific competence and capabilities of the staff at the regional centers, with guidance coming from a national coordinator. Above all, the coordinated research programs should help to generate closer interactions between scientists of different research centers in the national network.

The RRCs, like the NRCs, cannot be self-sufficient. As proposed, their greatest responsibility should lie in assembling and evolving packages of technologies relevant to the farmers' production systems in their zones by harnessing researches carried out by the national and international research centers, and by their own staffs. The emphasis will be on adaptive and applied research, with the basic concepts and resource materials flowing from the national centers.

The coordinated research projects are thus conceived as an instrument to mobilize the country's available scientific resources to focus attention on various problems of agricultural production and to find technological solutions to these problems through collaborative research. They help to generate inter-institutional and inter-disciplinary linkages and avoid unnecessary duplications. They also provide a mechanism for joint evaluation of new technologies through multi-location trials resulting in collective recommendations for the release of these technologies to farmers. The emphasis should be on defining the objectives and priorities clearly, laying down the procedures, and identifying the most relevant experimental approaches based on joint decisions. A higher degree of accountability based on continued monitoring by the project coordinator should be built into the system.

Structure of Coordinated Research Programs

Typically, a coordinated research program consists of a national coordination center and a number of cooperating centers located in different parts of the country. In the case of Kenya, the Mission recommends that the national coordination center should be set up at one of the NRCs, depending on the nature of the program. The cooperating centers should be located in the different RRCs, depending on the importance of the commodity or the product in the different regions. The coordination center will be headed by a project coordinator, who would be a senior scientist capable of providing scientific leadership for the national program. The coordinator would exercise little administrative control over the staff of the cooperating centers, which for all practical purposes are an integral part of the regional centers in which they are located. He must maintain contacts with the directors of the cooperating RRCs and with the concerned scientific staff to ensure that the part of the coordinated research program assigned to them is fully implemented. The coordinators would be expected to report directly to the Director General of KARI with regard to the funding of the coordinated programs and their progress. Funding support for these programs must be specifically provided in the budget of the different collaborating centers, indicating clearly the staff component and the funds available for their operating budget. The national coordinator would be asked to make recommendations in this regard.

It may be argued that the setting up of two different positions of authority in a NRC in the form of the director and the national coordinator could create administrative tensions. While this possibility cannot be ruled out, the advantages of having two distinct positions outweigh other considerations. The director of the center, with his administrative workload, cannot be expected to provide leadership of a nationally coordinated program, which would require a great deal of travelling and interaction with the scientists of the different centers on a continuing basis. The relationship between the director of the centers and the national coordinator must be based on mutual respect and trust on the basis of their respective standing. One is more of a research manager, while the other is more of a working scientist with some administrative responsibility. The identification of the cooperating centers in a coordinated program begins with the delineation of the different agro-ecological regions over which a particular crop or group of crops are distributed. In the case of Kenya, the agro-ecological regions have been clearly defined. The Mission presents elsewhere in this report details of the major agro-ecological zones and districts and important crops produced in them as well as problems encountered or likely to be encountered. This should provide the basis for identifying the national coordination center and the cooperating centers in different parts of the country for the different coordinated programs. Each cooperating center will have a team of scientists drawn from different disciplines such as plant breeding, agronomy, plant pathology, entomology, and soil science (or animal sciences) as appropriate. Obviously, it cannot be as strong a scientific team as the one at the coordinating national center, which would have major responsibility for that particular commodity or problem. Nevertheless, it should be an effective team to be able to undertake adaptive and applied research.

Functions of the Project Coordinator

The Project Coordinator should have the main responsibility for guiding and ensuring the implementation of the research program. He would assist in defining the responsibilities and research projects of the different cooperating centers. Most of these responsibilities should be identified on the basis of discussions at the annual workshop of scientists from the different cooperating centers. Such a workshop should be held at least once in a year at one of the centers. The results of research carried out at each of the participating centers would be presented by the respective group of scientists and by the coordinator in a documented form with the results reviewed by the coordinator in his annual report. The workshop provides the opportunity to plan the program of work for the next year at each of the cooperating and collaborating centers. It is in the course of these workshop discussions that strong inter-disciplinary and inter-institutional linkages are forged. There will of course be an element of competition between the different centers, but this is considered healthy for the success of the program. The discussions at the workshop should finally lead to recommendations about the release of new technologies to farmers.

The project coordinator, while he guides and monitors the work of the different cooperating centers, must also organize a research program of his own. This program, located as it is at the national center, would be expected to be particularly strong. The project coordinator is expected to strengthen the cooperating centers with a steady flow of genetic materials from different parts of the world and also from his own research work. In this sense, the project coordinator acts as a link between the cooperating centers of the program and International Agricultural Research Centers (IARCs) like CIMMYT, IITA, CIAT, and ICRISAT.

The other important responsibility of the project coordinator is to organize training programs for the benefit of the junior scientists located in different cooperating centers. These in-country training programs would be expected to be organized at the NRCs making use of the scientific strength and resources of the centers. The project coordinator should be able to initiate the recommendation for the training of some of the young scientists at the international centers and institutes in the developed and some of the developing countries.

The project coordinator has a responsibility to prepare reports for the Director General of KARI, drawing his attention to generated technologies which are considered ready for wider dissemination among the farmers. In this way he makes an important contribution to programs of agricultural development in the country.

Proposed Coordinated Research Programs

The Mission recommends that Kenya should organize coordinated research programs on all those crop commodities, factors, and animal research which transcend regional barriers and are of wider national significance. Their economic and social importance to the country should justify joint research efforts by a number of research centers located in different regions of the country. Similarly, coordinated programs should

be organized on problems relating to management of basic resources which affect agricultural production in large parts of the country. The most important single problem which has such a dominating role in determining Kenya's agricultural production is the problem of soil and water management. Large parts of the country have only a limited rainfall, even in normal years, and the topography of the country is such that there are serious problems of soil erosion and maintenance of soil fertility. Table 2.2 shows moisture availability in the different agro-ecological regions. Clearly there is a need to organize research in the area of soil and water management on a nationally coordinated basis.

Constraints of this kind help to decide on the number of coordinated research programs. It will be prudent, however, to restrict the number of nationally coordinated research programs in the initial stages to a few, and to gain experience about their working and then add to them. The Mission therefore recommends that a beginning should be made with a nationally coordinated research program in the following areas:

A. Crop/Commodity

i Maize
ii Root and tuber crops (cassava, yams)
iii Rice
iv Food legumes (beans and cowpea)
v Oilseeds
vi Horticultural crops

B. Animal Production

i Animal breeding
ii Animal physiology and nutrition
iii Pasture and fodder improvement and management

C. Soil/Water Management

D. Veterinary Research

It should be noted that, because of its nature, much veterinary research requires coordinated programs and that many such programs are operational at the present time. Concern about the increasing number of institutions engaged in animal disease research in Kenya led in 1981 to the formation of the 'Nairobi Cluster' of Institutes in Kenya cooperating in research on tick-borne diseases, trypanosomiasis, and their vectors. The memorandum of understanding signed by 12 institutes has as its purpose, 'to create a forum and framework for the exchange of ideas and information, to promote collaboration between scientists, to maximize utilization of resources and expertise, to facilitate training programs and to avoid duplication of effort'. Muguga and Kabete are included in the 'Nairobi Cluster' and so do not appear in Table 5.1 for veterinary research. In addition, some veterinary research programs, such as the rinderpest program, may be coordinated internationally. Soil/Water Management will be coordinated by Katumani, with all RRCs as cooperating centers.

The network of coordinating and cooperating centers for action for implementation of these programs is suggested in Table 5.1.

Table 5.1: Proposed Nationally Coordinated Programs

| Crop/Commodity/Stock | Coordinating Center | Cooperating Centers |
|---|---|---|
| Maize | National Maize Research Center, Kitale | Regional Research Center, Mtwapa<br>Regional Research Center, Kakamega<br>National Research Center, Katumani<br>Regional Research Center, Embu |
| Root and Tuber Crops | Regional Research Center, Mtwapa | Regional Research Center, Kakamega<br>Regional Research Center, Kisii<br>Regional Research Center, Embu |
| Rice | Regional Research Center, Mwea-Tebere | Regional Research Center, Kibos<br>National Irrigation Board, Ahero (NIDRC)<br>Regional Research Center, Garissa |
| Grain Legumes (Beans, Cowpea, Mungbean) etc. | Regional Research Center, Kakamega | National Horticultural Research Center, Thika<br>Regional Research Center, Mtwapa<br>National Research Center, Katumani |
| Oilseeds | National Wheat & Oilseed Research Center, Njoro | National Research Station, Kitale<br>National Seed Quality Research Center, Lanet<br>Regional Research Center, Mtwapa<br>National Research Center, Katumani<br>Regional Research Center, Kisii |
| Pastures & Forages | National Maize Research Center, Kitale | National Research Center, Katumani<br>National Range Research Center, Kiboko<br>National Animal Production Research Center, Naivasha<br>Regional Research Center, Mtwapa |
| Animal Breeding | National Animal Production Research Center, Naivasha | Regional Research Center, Kakamega<br>Regional Research Center, Kisii<br>National Research Center, Katumani<br>Regional Research Center, Mtwapa<br>National Range Research Center, Kiboko |
| Animal Physiology & Nutrition | National Agricultural Research Center, Muguga | National Research Center, Naivasha<br>Regional Research Center, Kakamega<br>Regional Research Center, Mtwapa/Mariakani<br>National Range Research Center, Kiboko<br>National Research Center, Katumani<br>National Research Center, Kitale |
| Horticultural Crops | National Horticultural Research Center, Thika | Regional Research Center, Kakamega<br>National Potato Research Center, Tigoni<br>Regional Research Center, Garissa<br>Regional Research Center, Mtwapa |

MANDATES

It is necessary to be specific in the mandates of NRCs and RRCs in relation to their programs, and the specific mandate for each center is given in Annex IV. Here we give the general mandate of the NRCs and the RRCs.

National Research Centers (NRCs)

1. Undertake applied and strategic research programs for generating improved genetic materials, and production technologies which will help to upgrade Kenya's agriculture and maintain its long-term productivity.

2. Collaborate with the international research centers of the Consultative Group on International Agricultural Research (CGIAR) system and other relevant centers for the introduction and evaluation of new genetic materials and other technologies, and the assessment of their suitability for different parts of Kenya.

3. Coordinate national programs of research through a network of cooperating RRCs. These programs should help to link up the NRCs and the RRCs into a network.

4. Distribute improved germplasm and breeding materials to RRCs to test them and make further selections in different agro-ecological regions.

5. Organize training courses for the young scientists from different centers in specialized fields in which the NRC has special competence and the leadership role.

6. Organize and undertake surveys in the country in order to monitor the build-up of pests and pathogens and suggest ways and means of checking and controlling epidemics.

7. Advise the planning departments of the government through the Director General of the reorganized KARI on the production potential of crops and livestock of national importance and the strategy required to achieve their production potential over a period of time.

Regional Research Centers (RRCs)

1. Organize farming systems research and obtain a clear understanding of the existing crop and animal production practices with a view to upgrading these production systems through a process of scientific transformation. In other words, such centers should know their clients and their needs for a more productive agriculture.

2. Analyze the strengths and weaknesses of the existing production systems and opportunities for improving them through scientific innovations. RRCs' research to be planned on this basis.

3. Assemble and test different production technology packages by harnessing improved materials and research results available from the national and international research centers. The emphasis would be on adaptive research with a leading role in crop production for agronomists. These packages should be so designed as to ensure that they can increase the productivity and profitability of the existing and modified production systems. In the second phase, an attempt should be made to modify the existing production systems in order to move into high-productivity agriculture.

4. Generate new technologies through applied research to fill in gaps identified while assembling suitable technology packages for farmers in the region. This would call for multi-disciplinary research in the fields of crop improvement, crop and animal production and protection, and soil and water management.

5. Cooperate with NRCs in sharing research responsibilities for work relating to different agro-ecological zones.

6. Develop close linkages with the extension services to receive feedback on grass-root problems of the farmers, and to communicate to them the tested and proven results of new technologies.

7. Organize training programs for the extension staff and farmers.

# CHAPTER 6: RESEARCH SUPPORT SERVICES AND RESEARCH CENTER DEVELOPMENT

## Introduction

It is estimated that Kenya's expenditure for agricultural research exceeds K£ 10 million annually. Considering the emoluments paid to the number of persons working in the research support services, the costs of research support facilities, and the maintanence thereof, one may conclude that a major portion of this expenditure is utilized for the support of research. Yet the attention devoted to the development, organization, and management of service staff and research support facilities has to date been minimal.

The scientists are dedicated to the task of finding solutions to the food crises that will arise if the population increases as predicted. Most of those involved in agricultural research are aware of the urgency and are prepared to give full attention to research and its results. At experiment stations one can see crop, animal, and laboratory experiments which attest to current efforts of the scientific community. Not so obvious, however, are the research support staff and facilities so vital to the conduct of meaningful and efficient agricultural research.

When one looks beyond the obvious, that is, beyond the research experiments and data compiled therefrom, at the long chain of interconnected ideas, people, activities, and support functions that must be organized in order to produce agricultural research, it is found that scientists, whose mandate, training, and interest are research, spend an inappropriate amount of their time obtaining facilities and managing support staff.

The inadequacies of research support facilities and their management are high among the major constraints to agricultural research.

The Government of Kenya, other governments, international and private organizations, have over the years invested heavily in equipment, buildings, educational, and training programs for the development and support of agricultural research.

The investment in education and training of scientists is poised to pay meaningful dividends. However, the investment in equipment, buildings, etc., and sometimes training of service staff, to support the scientists, has in most cases been an expensive endeavor with limited benefit.

Visual evidence of the truth of this statement was found by visits to the workshops, laboratories, and fields. Quantities of imported and domestic equipment were found inoperative, and "research fields" unused. Inadequate infrastructure, management, organization and support are largely responsible for this unsatisfactory situation.

Previous Page Blank

The Mission found that research support is provided by a few poorly trained, low-paid, and often unmotivated staff who have inadequate equipment and facilities. Yet they are expected to provide unstinted research support services and facilities to their trained and specialized research colleagues.

Research staff must have adequate services and facilities in order for Kenya to reap maximum benefits from the scientists' experience, education, and research endeavors. This support is necessary to promote adequate long-term motivation, and to produce timely, significant research results, upon which Kenya's economic survival depends.

Today there is in Kenya an awareness of the need for qualified agricultural scientists to lead the way to increased production. The education and training of scientists is only the first step towards the establishment of a viable agricultural research organization.

Adequately trained scientists must be supported by an adequately qualified cadre of support staff; otherwise the investments in training, research facilities, and equipment cannot be fully utilized. The ratio of support staff to research scientists varies from situation to situation, depending on the research mandate, availability of equipment, facilities, local services, and the capacity of support staff and the scientist.

It is to be realized that for productive research a certain minimum number of research support staff should be available per scientist and that all the support staff, as well as the scientists, must be fully qualified, dedicated, and co-operative, with the accomplishment of the research objectives as their common goal.

Currently Kenya, in some disciplines, has reached, or is approaching, a "critical mass" of agricultural scientists and tremendous efforts are being made to increase this quantity. However, insufficient attention has been devoted to the establishment of specific academic and training programs necessary to qualify and provide the other members of the research team. Therefore, today a major constraint to productive agricultural research is the non-availability of qualified support staff in the management, administrative, and operational services.

The challenge is for the provision of academic and on the job training programs for research support staff. This will be an "uphill task", as it was a few years ago, for the establishment of education and training facilities for agricultural research specialists.

Recruitment and training must be for the entire spectrum of research institute support personnel. This encompasses Station Directors, Administrators, and Managers of Physical Plant Services, Farm Services, Personnel Services, Analytical Laboratories, Purchase & Supplies Services, and a host of other support managerial positions, as well as their technical supervisors and subordinates. Although efforts and finances for the development of qualified research professionals must continue, it is now evident that a matching level of competence must also be developed in the research support cadre.

The Mission recommends that attention be devoted to:

1. the development and promotion of policies, as also the training and finance, necessary to provide adequate services at the research and subcenter level,

2. specific organization and management policies, practices, and procedures required to develop and maintain effective services,

3. the development of esprit de corps among research and support staff, and co-operation between these two groups,

4. academic and practical training programs designed to interest and prepare young people for a professional career in research support,

5. career opportunities and professional recognition sufficient to encourage entrants into the service professions, as also to retain qualified incumbents.

Research Support Services

Universally there has been a general lack of understanding as to what constitutes the research support services of an agricultural research organization at the research institute (center) level.

The Mission, while reviewing the Kenya agricultural research station's support services and infrastructure, has considered the services to be those classified as follows:

1. Administrative Services
2. Research Services
3. Physical Plant Services
4. Farm Operations
5. Augmentation Services

The details of these services are presented in Annex V.

Administrative Services

The administrative services of a research institute are those which manage aspects of the institute similar to those required in commercial/government organizations of equivalent size. The managers of the administrative units - personnel, finance, purchasing, vigilance, travel, etc., - must be qualified professionals. However, in addition to their professional competence, they must be aware and appreciate that the management of the administrative services of an agricultural research institute differs from that of the management of a business organization, in that research data and results, not profit, are the primary objective of the institute. Therefore, the straightforward application of standard business procedures, or the bureaucracy of government practices, may not adequately serve research.

Fisher (1980) writes:

> ".....The way management deals with personnel in a research institution, a hospital, an education institution, or a technical agency must be quite different from the way management might deal with people in, for example, a public works program."

Research Services

Research Services are those which directly support research, and can be thought of as research partners, as some working in them may occasionally spend a portion of their time in the conduct of research directly related to the research mandate of the institute or center.

Depending on the center's area of research, some of the functions considered as research services in one center are, in others, full-fledged research disciplines.

Research service units may at times have a secondary research component, in that they conduct research in their own technical field in order to provide the required services to research. For example, if biochemistry is required to provide a new basic biochemical analysis, it will be necessary to develop and perfect new analytical techniques.

Physical Plant Services

Physical Plant Services, known as Engineering Services in some organizations, in general provide engineering and maintenance services for the entire institute/center. The major sections of Physical Plant Services (PPS) are:

1. Mechanical Engineering and Maintenance
2. Electrical Engineering and Maintenance
3. Civil Engineering and Maintenance
4. Electronic and Scientific Instrument Engineering and Maintenance

A more complete description of the organization, and the role Physical Plant Services play in the support of agricultural research, is described in Vol. II.

Farm Operations or Farm Services

The title itself is self-explanatory, as this service group supplies and manages the field support operations, etc., necessary to support field-oriented research.

In addition to field support, the farm operations group in many centers also operate facilities, such as glasshouses, screenhouses, constant temperature and humidity controlled plant growth facilities, etc.

The operations and services performed by the farm operations unit vary from center to center, depending on the research mandate. For instance, in a livestock-oriented research center a major requirement would be the provision of feed and pasture, and perhaps animals for research, whereas in a plant-breeding center the services required are primarily agronomy-oriented.

A more complete description of the organizational, managerial, and operational aspects of Farm Operations will be provided to the reorganized national research system.

Augmentation Services

There are a number of pursuits in most Agricultural Research Centers that cannot clearly be classified as Research.

These are departments which disseminate knowledge in the form of printed and verbal information, etc., and also disseminate the material products of research, such as improved seed, plants, machinery, and even animals, fish or poultry, depending on the center's research mandate.

Such departments, which may be covered by the appellation of 'Augmentation Services', or are sometimes regarded as Research Support, at the research institute level, do not give direct support to the research in the institute, but are universally found in most institutions. They deal with the 'products' - material and otherwise - resultant from scientific research, and assist institutional management in the dissemination of information, etc.

Constraints to and Recommendations for the Enhancement of the Research Support Infrastructure

General

These recommendations are based on the assumption that the services will operate within the framework of a reorganized semiautonomous organization in which the organization and research centers' heads have considered managerial flexibility.

At the present time the staff of the Administration Service and a major portion of the physical plant service are supplied by other ministries. Therefore the research station management has little control of the services supplied or the recruitment, development, and training of the required staff. Likewise the Director of Research and the research station heads must adhere to government finance, purchase, recruitment, and personnel policies which were not designed for the administration and management of agricultural and veterinary research organizations. Consequently these policies do not provide an adequate framework for the development of a viable research and research support infrastructure.

Table 6.1 was developed from the ISNAR, Research Stations Questionnaire, completed by a number of the station directors. From this table it will be seen that many of the constraints stem from inadequate personnel, finance, and procurement policies, as well as inadequate funds.

In the reorganization of a semi-autonomous research organization with full responsibility for the development, organization, and management of its research support infrastructure, it must be realized that currently a number of the required services (although frequently inadequate) are supplied by other ministries. Therefore appropriate finance, and in some cases personnel (administration), may need to be transfered from those ministries or as an alternative provided to the research organization.

Administration Services

The research station (center) head (Officer-in-charge or Director) is viewed as the head of all station research support services. He is responsible for the direction of research activities at his station and the provision and coordination of research support for the achievement of the research mandate.

TABLE 6.1: Constraints to Agricultural Research in Kenya at the Research Station Level: As Identified by the Station Directors

| CONSTRAINTS | STATION CODE | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 03 | 04 | 05 | 06 | 07 | 08 | 09 | 10 | 11 | 15 | 16 | 17 | 18 | 19 | 20 | 32 | 33 | 35 | 41 | 42 | 43 | 44 | % |
| Lack of; | | | | | | | | | | | | | | | | | | | | | | | |
| 1. Research staff | X | X | X | X | X | X | X | X | X | X | X | X | X | | X | X | X | X | | X | X | X | 100 |
| 2. Support staff | X | X | X | X | X | X | X | X | X | X | X | X | X | | X | X | X | X | | X | X | X | 100 |
| 3. Land for research/space | X | | | X | | | | | | X | | | X | | | | | X | | | | | 25 |
| 4. Buildings (office, lab, work space) | X | X | | X | X | X | X | | X | X | X | X | X | | X | X | X | X | | X | X | X | 90 |
| 5. Equipment (farm, office, lab.) | X | X | X | X | X | X | X | | X | X | X | X | X | | X | X | X | X | | X | X | X | 95 |
| 6. Amenities (housing, medical, schools, transport) | X | X | | | X | X | X | X | X | X | | | X | | X | X | X | X | | X | X | X | 80 |
| 7. Vehicles | X | X | | | X | | X | X | | X | X | | X | | X | | X | X | | | X | X | 65 |
| 8. Finances | X | X | | X | X | X | | X | X | X | X | X | X | | X | X | X | X | | X | X | X | 90 |
| 9. Flexibility in utilization of funds (procurement, etc.) | X | X | X | | X | X | | X | X | X | X | X | | | | X | X | X | | | | | 65 |
| 10. Maintenance for buildings, vehicles, equipment, etc. | X | X | X | X | X | X | X | X | X | X | X | X | X | | X | | X | X | | X | | X | 90 |
| 11. Research direction | | | | X | | | | X | X | | X | X | | | | | X | X | | | | | 35 |
| 12. Involvement of station in SRD's decision (placement of staff, financing, etc.) | X | | X | X | | | | | | | | X | | | | X | X | | | | | | 30 |
| 13. Adequate power supply | X | | | | | | | | | X | | | | | | | | | | | X | X | 20 |
| 14. Library facilities | | X | | X | X | | X | | X | X | X | | | | X | X | X | X | | | | | 55 |
| 15. Water &/or irrigation facilities | X | X | | X | X | X | X | X | | | | | | | | | | X | | | X | X | 50 |
| Other Constraints; | | | | | | | | | | | | | | | | | | | | | | | |
| 16. Staff attrition | X | | X | X | X | X | X | X | X | X | | | X | | | X | X | X | | X | | | 70 |
| 17. Excess scientific staff | | | | | | | | | | | | | | | | | | | | | | | 0 |
| 18. Excess skilled/unskilled staff | | | | X | | | X | | | | | | | | | | | | | | | | 10 |
| 19. Training | X | X | X | X | X | X | X | | X | X | | X | X | | X | | | X | | X | | | 70 |

Note: % = number of stations listing the constraint divided by 20 (total number of questionnaires received) x 100.

It is to be realized that when a scientist whose academic training, experience, and interest is research is promoted to a senior administrative position, he may experience frustration and loss of direction. At this time or soon thereafter a considerable amount of retraining in administrative procedure, personnel management and the study of organizations procedures to prepare him for this new role should be provided.

A detailed study of the capacity and administrative abilities of the different research station heads was made by the ISNAR team. The observations and discussions and a review of the different stations revealed a vast contrast in attention to details and aptitudes.

Organization of Research Support Services

While the functions of the recommended positions of Deputy Directors (Figure 9.1) in the areas of crops/soils and livestock research can be easily defined by the context of the research programs and priorities discussed earlier, the same is not true for the positions of Deputy Directors in Research Support and Planning, Finance, and Administration. The Mission therefore considers that the following details should be provided in respect of these positions and of the positions of their principal assistants.

Planning, Finance and Administration Division

The Deputy Director of the Planning, Finance & Administration Division must be a qualified and experienced administrator. He should be assisted by a Senior Finance Officer, Personnel Officer, Purchase and Supplies Officer and a Senior Librarian, and secretarial and clerical staff as required.

This division must operate as a service or advisory team. Their objective must be to assist the center director in such a way as to free him from bureaucratic procedures in order that he may devote a major portion of his time to the direction and management of research. The staff of this division must not in any way have authority or jurisdiction over the center directors. The center director must have a considerable degree of flexibility over the utilization of funds allocated and the resources available to him. However, the administrative division would be required to conduct or arrange for the audit of center records to ensure that appropriate administrative procedures (checks and balances) are being maintained.

It is considered important that each national and regional center's budget be proportioned and allotted to the respective research and service division heads. The rationale for this recommendation is as follows: the practice at some centers (and it is assumed to be true for all) is for the center director to keep all funds with him and to therefore approve all expenditures regardless of the size or nature of the purchase. This is perhaps essential, due to the scarcity of funds, the lack of experience of subordinate department heads, the availability of qualified clerical staff in the departments, and the current overwhelming purchasing policies.

The advantages of suballocation of funds and financial responsibility to the different research center department heads are:

1. It would free the center director from many of the time-consuming tasks of direct control of numerous small purchases.

2. It would instil considerable financial responsibility and awareness in the department heads and thus give some cogitation to their research direction and request for funds. A number of station directors complained that their staff had no sense of the cost of some of their requests.

It is realized, under the current circumstances, that the subdivision of centers funds may not be practical. However, this should be a long-term objective once an appropriate degree of autonomy for financial matters is achieved.

A major function of the Assistant Director (Finance and Administration) should be to assist the center director in the selection and training of administrative, clerical, and secretarial staff who will report to and be supervised by the center director and not the senior administrative officer at the national division.

As the senior finance officer he should also be responsible for the distribution of funds to the centers as per the instructions of the Director or Deputy Director and to assist center directors and their accountants in the preparation of cash flow projections. If autonomy and responsibility for payroll disbursement is given to the Research Organization, this function would probably be best handled at the national level, preferably through a computerized payroll system.

The complicated procedures for quotations and the purchase of imported equipment and spare parts should be processed for the station by the finance and purchase officers.

Some of the functions of the officer responsible for personnel matters within the Division should be to:

1. Assist in the development and implementation of uniform, 'Schemes of Service Policies' for all staff categories in both research and support service cadres.

2. The identification of appropriate training courses for both research and support staff, as requested by the station directors or divisional deputy directors. This service should include not only the identification of required academic and professional courses but should also assist in the identification of financial support and the necessary correspondence as well as in the processing of required documents.

3. Assist in the development and implementation of a comprehensive staff appraisal system for all levels of staff in both research and support posts (the present staff appraisal system applies to only the staff in job group K and above). The objectives of the appraisal system must be, to reward high performers, to encourage and improve medium and low performers and in extreme cases serve as a record or basis for disciplinary action.

4. Serve as the reviewing officer where drastic disciplinary action is deemed necessary or appropriate by the center director for senior research and service staff (K and above).

Senior Purchases and Stores Officer

There should be a Senior Purchases and Stores Officer. This officer should:

1. Assist in the development and implementation of policies and procedures for purchase and storage of goods. The objective must be to streamline the procedures in order to expedite local purchases by the station director's staff. The current cumbersome and bureaucratic procedures are listed by station directors as one of their major constraints. The storage of spare parts, fertilizers, pesticides, and flammable goods at the research station in very inadequate facilities or in the laboratories was viewed as being a hazard at many stations. Certainly additional appropriate facilities are required. However, a very necessary interim requirement is the formulation and implementation of appropriate policies and safety procedures.

2. Be responsible for obtaining quotations from national suppliers for the purchase of major capital equipment items such as tractors, combines, computers, etc.

3. Be responsible for the purchase of items to be directly imported by the research organization.

4. Assist the station staff in periodic inventories of station equipment and stores.

5. Assist in the recruitment of station staff for purchases and stores and conduct appropriate training classes as required.

6. Develop appropriate and workable property disposal procedures. Currently most of the research stations are littered with numerous items of machinery and vehicles which have been or should be boarded and disposed of. The present procedures appear unworkable or extremely slow.

Senior Librarian

Considering the present shortfall in Library and Documentation services and the coordination and supervision required to improve this essential research service, it is recommended that a Senior Librarian be located at the headquarters of the reorganized KARI. His first task should be to improve the filing and retrieval service for the Director of KARI.

Review of the libraries at all stations (except Muguga) revealed very meagre facilities with very few publications relevant to the research being conducted at that station.

The Senior Librarian should be responsible for:

1. The improvement of library and documentation facilities for agricultural research at Muguga and elsewhere.

2. The identification and purchase of additional required publications from national and international sources. This will require a certain amount of foreign exchange and would be a very worthwhile long-term investment for an interested external assistance agency.

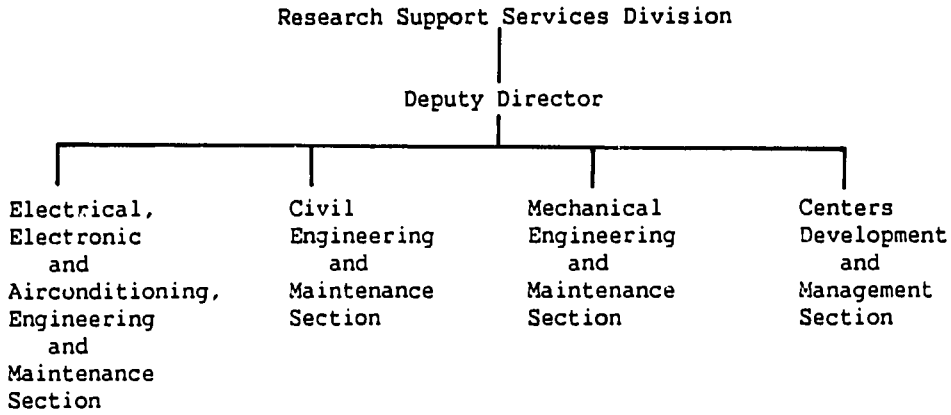
3. The development of a computerized international reference search facility. This is viewed as a long-term objective which will again require foreign exchange and perhaps external assistance. The absence of references on previous research accomplishments and investigations by other scientists around the world is viewed as a major constraint to Kenyan scientists and one of the reasons for the lack of achievements and directions of some of the research programs. Certainly, there must always be an exhaustive literature review prior to the development of any research program. The Senior Librarian and station librarians must have the capacity to assist in this search.

4. Assisting in the recruitment, and if necessary the training, of librarians for each national and regional center. It was found that very few stations had a qualified librarian and that at some centers the "library" was managed by a daily paid or casual employee. A major constraint at most stations was the absence of qualified personnel for editing and assembling of the annual report and other station-level research papers. It is recommended that the librarians at the research station level be sufficiently educated to assist in the editing of reports and the reproduction of these and other required documents.

Research Support Services Division

This division is to be headed by a Deputy Director with appropriate academic qualifications and experience in the development and maintenance of research facilities. It is considered imperative that this deputy director be of equal rank with that of the other research divisions' deputy directors, as he, along with them, must compete for funds and be a part of all decisions taken for the conduct of research. This is necessary, as this division must supply, operate, and maintain the entire research support infrastructure and facilities which today is seen to be extremely fragile and in some areas virtually non-existent. Any decision for new or redirection of research must be taken in view of the service division's capacity to provide the required facilities and service staff. Therefore, the research support services division must have an input at the decision-making level and be provided the required funds.

It is recommended that the Research Support Services division be composed of four sections of equal rank, the organization of which appears below:




At the national level the four sections would be supervised by engineers or technologists with appropriate qualifications and experience.

One of the first tasks of this section would be to take a detailed inventory of all equipment and facilities currently at existing research stations. The second task, after the approval of the new research mandates proposed and the new network of national and regional centers set up, would be the redistribution of serviceable, moveable assets according to the mandates and requirements of the different centers. This recommendation is made with the assumption that some stations will probably be closed and with the knowledge that some quantities of serviceable equipment exist at some stations which are not required as per their current research mandates.

A major function of each of the four divisions should be the selection and training of service personnel to be located at the different research centers under the center directors.

A brief summary of the functions and objectives of the four sections is as follows:

1. Electrical, Electronic and Airconditioning, Engineering and Maintenance Section.

An excellent beginning has been made in the development of this section. An electronic engineer, a number of electronic TAs, a mechanical TA and an airconditioning TA have been employed, and training is in progress for some of the TAs.

The plan is to, after training, station the TAs at national research centers for day-to-day maintenance of laboratory equipment. For major repairs the TAs will be assisted by the electronic engineer who is the head of the section and stationed at NAL.

Service at the research station level has already begun and the station directors give high marks for the services provided to date. This service should be expanded to include additional TAs as also an electrical engineer and electrician to be stationed at the research stations.

The service should be expanded to include the service of office and photocopy equipment, either by the section's staff or under the section's direction by local dealers or service contractors. Detailed references to the operation of maintenance contracts and the operations and functions of this type of service unit can be provided.

It is recommended that the purchase of all laboratory instruments and equipment for the research centers be processed through the engineering and maintenance unit. The unit should strive to standardize the purchase of equipment as much as possible. Standardization of equipment, wherever possible, will reduce the variety of spare parts, lessen the inventory, and minimize the requirements for additional training of the operational and service staff.

Many aid programs, as part of their assistance, provide numerous items of equipment. All such assistance must be coordinated with this division in order that the supply of equipment may be regularized and provisions made for its long-term maintenance.

A major activity of this section must be, not only the training of service staff but also the training of operational TAs and research staff in the proper use of the equipment.

2. Civil Engineering and Maintenance Section

Construction and maintenance of buildings at the present is the responsibility of the Ministry of Works. It is recommended that the research institute and research station take over this responsibility once semi-autonomy is achieved.

This will be a major task for this division and the civil engineering and maintenance section as the infrastructure, policies, and procedures for its operation are to be developed.

The section head should be a professionally qualified civil engineer or architect with a number of years experience in the construction industry.

The first task will be to take stock of the current situation as to the status of the numerous uncompleted building programs currently "on hold" at many research stations. It is to be realized that the mandate of some of the stations may change; thus some of the buildings now planned or under construction may not be required. At most of the stations new buildings will be required. It is assumed that funds for new construction may come from both government and external agencies. All building programs must be coordinated with the Deputy Director of the Research Support Services Division.

Details of the organization and staff of the civil section are to be developed. However, it is foreseen that it would consist of at least two units:

(i) Civil engineering and maintenance unit: This unit would coordinate with the station director for the planning of new construction and the repair and maintenance of existing buildings.

The unit would also be responsible for the development of building plans through selected architects, the securing of funds, and preparations for tendering, contracting, and supervision of construction. The center director should be kept informed at all stages.

(ii) Architectural unit: It will be advisable to have a small architectural unit in the section. The unit would coordinate with the building design architects for large structures and possibly prepare drawings and specifications for small, simple structures, such as storage and workshop buildings.

Many stations now have drawings developed for their stations. The architectural unit should collect copies of all drawings and develop a central file. An attempt should be made to develop standard designs for office and laboratory buildings wherever possible. The use of standard but expandable building designs will result in major cost reductions for architectural fees, tendering, construction, and on-site supervision.

3. Mechanical Engineering and Maintenance Section

This section should be managed by an agricultural engineer with appropriate qualifications in farm power. He must have a broad technical knowledge of the operation and maintenance of agricultural tractors and equipment as also that of ordinary vehicles.

Some of the major responsibilities of the section should be to:

(i) Develop a well-equipped maintenance and repair workshop at each of the research centers.

(ii) Assist in the selection and training of mechanics for both vehicles and farm machinery.

(iii) Advise research stations on the types and qualities of commercial and specialized research support machinery required at the different centers. These recommendations will be based upon the research mandate of the center and the amount of land utilized.

(iv) Strive for standardization of equipment and vehicles wherever possible in order to reduce spare parts inventories, the requirements for specialized maintenance tools, and special training courses for service staff.

(v) Assist stations in tendering for and the purchase of equipment and vehicles.

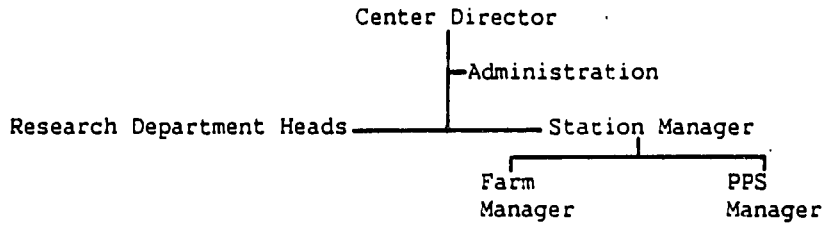
(vi) When required, assist the station in the procurement of imported spare parts for the maintenance of special equipment and for the purchase of specialized machinery which cannot be obtained from national sources.

(vii) Coordinate with aid agencies for the provision of vehicles and farm equipment.

In the initial stages of reorganization and the consolidation of resources for the support of research, this section will have a major role to play in the screening and rehabilitation of vehicles, tractors, and farm machinery currently inoperative at all stations. Many of these items still have years of economical service left in them. The requirement will be for funds for spare parts and a qualified repair team to repair the equipment or arrange for its repair through local agencies.

4. Station Development and Management Section

The organizational pattern at the national and regional centers should be as follows:




A more detailed description of this organizational concept and some of the management procedures of the different sections reporting to the center director can be provided.

At the smaller centers there should only be a senior farm manager reporting directly to the center director.

At the national level the manager of the Station Development and Management Sections should be a qualified agricultural engineer in either soil and water management or farm power. He should have had several years of experience in the development and management of large farms or similar facilities. Depending on the number and size of station development projects to be undertaken, the section manager should be assisted by engineers or diplomates with appropriate training and experience.

This unit would work with the other three section managers and the concerned center director for the development and implementation of the research center's development and management plans.

Presently, at many research stations, the farm operations or management position is given to the most junior and least-experienced TA, who must somehow, with little training and supervision, provide essential support services for the conduct of research. Consequently, at many stations, the function of the centralized farm operations unit is primarily that of plowing the fields and the operation of a small ill-equipped farm shop. The remaining farm operations, which should be carried out in the research plots by the farm operations unit, are usually performed by a number of TAs in each research department. A review of the manpower chart of the 20 stations surveyed supports this statement.

This overstaffing of TAs in the research departments is expensive and unnecessary. One of the very important responsibilities of the National Station Development and Management Section should be, through training and the enhancement of facilities, the upgrading of the capacity of Farm Operations Sections in order to provide a more economical and effective service.

Costs of Research Center Development

In view of the state of research support services in the existing research stations, there will be the need for major capital and operational investment in the development of 13 National Research Centers and the six Regional Research Centers proposed for the rationalized network. Much of this investment will go into the rehabilitation of existing infrastructure and some construction of new infrastructure. Details of this can be worked out and provided to the project preparation teams that would work on the preparation of projects for research center development.

# CHAPTER 7: FUNDING OF AGRICULTURAL RESEARCH

## 7.1 Sources and Pattern of Funding

The bulk of agricultural research funds in Kenya is provided by the Government through MOALD. This has always been the pattern except for two years (1982/1983) when the Ministry of Regional Development, Science and Technology provided appropriations for KARI . Also, when the Ministries of Agriculture and Livestock Development were separate, they provided funds for agriculture and livestock research separately.

Besides the Ministry, agricultural research is also carried out at the Coffee Research Foundation (CRF), the Tea Research Foundation (TRF), the research arm of the National Irrigation Board, and at the University of Nairobi. All these institutions, plus a number of international research centers and regional programs based in Kenya, provide a solid base for productive agricultural research. Table 7.1 presents the levels of funding for agricultural research during the last five years. Agriculture and livestock development gets about seven percent of total government budget - its shares in the recurrent and development budgets are about five and 12 percent, respectively. These allocations in part reflect the large number of new development projects in progress.

It should be noted, however, that over time these shares have fallen. The share of MOALD funds allocated to research have remained stable at about 11 percent over the last six-seven years. This means that there has been a marked decline in the shares of recurrent funding and some increases in development grants, though these continue to be very small. Clearly, the Scientific Research Division (SRD) has not been able to retain its proportionate claim on recurrent funds at a time when MOALD's own share in total government grants was stable if not rising. This situation has led to the emergence of inadequate recurrent funding as a major and critical constraint in research; this constraint was mentioned by virtually all research station directors.

Table 7.2 shows the trend in research expenditures over the last decade; these pertain to MOALD funds only. There was a more than seven-fold increase in research expenditures between 1972 and 1982. Even in real terms, expenditures more than doubled over this period. It is also clear that the bulk of this growth occurred in the 1970s - real expenditures have remained more or less stagnant over the last five years. Institutional problems, mainly the creation of separate ministries for agriculture and livestock development, and the resulting need to sort out jurisdictions and responsibilities, perhaps resulted in this deceleration. As we can see from Table 7.1, proposed allocations for 1984-85 are higher by K£ 1.2 million over 1983-84, something which has happened only once since 1977-78. We believe this signifies a recovery.

Previous Page Blank

Table 7.1: Expenditure on Agricultural and Livestock Research[1]
MOALD: 1978-79 to 1984-85

| | | 1978-79 K£ Million | 1979-80 K£ Million | 1983-84 K£ Million | Current 1984-85 K£ Million |
|---|---|---|---|---|---|
| I (a) Total recurrent expenditure | GOK | 485.90 | 502.09 | 991.35 | 1112.80 |
| (b) Total Development Exp. | GOK | 268.21 | 242.96 | 300.34 | 353.43 |
| (c) Total Govt. Expenditure | GOK | 754.11 | 745.05 | 1291.69 | 1466.23 |
| II (a) Total Rec. Expenditure | MOALD | 21.66 | 23.57 | 42.24 | 58.25 |
| (b) Total Dev. Expenditure | MOALD | 38.00 | 36.88 | 37.12 | 42.67 |
| (c) Total Expenditure | MOALD | 59.66 | 60.45 | 79.36 | 100.92 |
| III (a) Rec. Expenditure on agric. livestock res. | MOALD | 4.65 | 5.11 | 7.50[2] | 8.27 |
| (b) Dev. Expenditure on agric. livestock res. | MOALD | 1.18 | 2.13 | 2.32[2] | 2.80 |
| (c) Total Expenditure on agric. livestock res. | MOALD | 5.83 | 7.24 | 9.82[2] | 11.01 |
| IV II(a) as percent of I(a) | | 4.4 | 4.7 | 4.3 | 5.2 |
| II(b) as percent of I(b) | | 14.2 | 15.2 | 12.3 | 12.1 |
| II(c) as percent of I(c) | | 7.9 | 8.1 | 6.1 | 6.9 |
| III(a) as percent of II(a) | | 21.5 | 21.7 | 17.7 | 14.2 |
| III(b) as percent of II(b) | | 3.1 | 5.8 | 6.2 | 6.6 |
| III(c) as percent of II(c) | | 9.8 | 12.0 | 12.4 | 11.0 |

[1] Excludes Tea and Coffee Research, University of Nairobi, National Irrigation Board.

[2] Includes funds for KARI from Ministry of Regional Development Science and Technology.

Table 7.2: Trend in Research Expenditures
(At current and constant prices) 1972-73/1984-85

| Year | Agric. GDP at current prices | Research Exp-, enditures[1] at current prices | Res. Expenditure at constant (1976) prices | Res. Exp. as % of Agric. GDP |
|---|---|---|---|---|
| | K£ million | K£ million | K£ million | |
| 1972/73 | 232.6 | 1.40 | 2.60 | 0.60 |
| 1973/74 | 269.0 | 2.13 | 3.50 | 0.79 |
| 1974/75 | 319.3 | 2.40 | 4.03 | 0.90 |
| 1975/76 | 346.3 | 2.93 | 3.91 | 0.85 |
| 1976/77 | 466.1 | 3.67 | 3.67 | 0.79 |
| 1977/78 | 668.0 | 5.73 | 4.40 | 0.56 |
| 1978/79 | 631.7 | 6.37 | 5.40 | 1.01 |
| 1979/80 | 648.8 | 7.01 | 5.70 | 1.08 |
| 1980/81 | 688.1 | 7.31 | 5.54 | 1.06 |
| 1981/82 | 791.7 | 8.95 | 6.26 | 1.13 |
| 1982/83 | 907.2 | 9.40[2] | 5.99 | 1.03 |

[1] Up to 1979-80 from Wang'ati, F.J. (1981). Allocation of resources to agricultural research. Mimeo. Nairobi. For later years, from government expenditure and estimates.

[2] Tentative figure.

MOALD expenditure on agricultural and livestock research has always been higher than 0.5% and has consistently exceeded one percent of agricultural GDP since 1978/79. This level was attained after a very rapid growth in the 1970s and has since remained more or less stable. In fact, if we add about K£ two million spent by CRF, TRF, and the National Irrigation Board, and about K£ three million provided as external assistance, the total would equal nearly 1.6 percent of agricultural GDP. Perhaps only very few other developing countries can match Kenya's record in this regard. The requirements of the research strategy, plan and priority programs discussed in this document would necessitate progressive increase in the resources allocated to research to attain the level of two percent of Kenya's agricultural GDP within the next few years.

Although Tables 7.1 and 7.2 convey the impression of solid and consistent support for agricultural research, the problem seems to be in the balance within the funds provided, especially in respect to the ratio of personnel costs to operating costs (Tables 7.3 and 7.4). A significant shift in relative shares, both for SRD and KARI, can be observed between 1979-80 and 1984-85 (Table 7.3). In both cases, there have been substantial increases (124 percent for SRD and 105 percent for KARI) in the salary and allowances component over the last five years. In SRD, there has been an absolute decline in capital investment and miscellaneous, and only a 32 percent increase in operating expenses, whereas at KARI there has been an absolute decline in almost all non-salary components. The result has been a major deterioration in the operating expenses:salary ratio for both institutions. This decline has important implications because it signifies a decline in operational support for scientists in real terms, and this partly accounts for the low research productivity observed in many instances by the Mission. It is clear that the bulk of additional funds over these years (89 percent for MOALD and 120 percent for KARI - in the latter case salaries have accounted for not only all the increase but also part of the operating expenses) have gone to salaries.

The comparable ratios for CRF and TRF show a much healthier situation and are in line with recommended ratios of 65:35. It is of interest to note that this used to be the situation in MOALD institutions as well in 1979-80.

Table 7.4 further highlights this point with reference to deployment of recurrent funds. The fact that the current ratio is somewhat better for total rather than recurrent funds suggests that development grants are supplementing recurrent operating expenses.

These tables reveal a basic problem in research funding in Kenya. SRD has not been able to maintain its share of recurrent grants, yet it has continued to expand - mainly by adding more staff and upgrading small research stations. It now finds itself in a position in which its funds are inadequate to provide the required level of support to its scientists. Thus, in spite of sizeable total investment in agricultural research, the funding pattern is clearly inefficient. In short, there are too many scientists and too little money to support them to engage in productive research. By following an employment-oriented expansion, the system has shackled itself.

Table 7.3: Pattern of Deployment of Total (Recurrent and Development) Funds in Agricultural and Livestock Research

| Category | Agric. & Livestock Research (MOALD) | | | | Kenya Agric. Research Institute (KARI) | | | | Coffee Res. Found. | | Tea Res. Found. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1979/80 | | 1984/85 | | 1979/80 | | 1984/85 | | 1982/83 | | 1982/83 | |
| | Amount(K£) | % | Amount(K£) | % | Amount(K£) | % | Amount(K£) | % | Amount(K£) | % | Amount(K£) | % |
| 1. Salary and allowances | 2,136,187 | 41 | 4,788,420 | 58 | 926,379 | 46 | 1,896,500 | 67 | 675,538 | 61 | 158,195 | 29 |
| 2. Capital Investment | 1,587,368 | 31 | 1,438,571 | 18 | 479,987 | 24 | 352,020 | 13 | 21,023 | 2 | * | - |
| 3. Transport | 401,675 | 8 | 544,863 | 7 | 118,342 | 6 | 115,000 | 4 | * | - | * | - |
| 4. Training | 48,888 | 1 | 69,898 | 1 | 18,978 | 1 | 1,210 | neg. | * | - | * | - |
| 5. Experiment Station | 948,346 | 18 | 1,259,206 | 15 | 428,645 | 21 | 434,440 | 15 | * | - | * | - |
| 6. Miscellaneous | 68,390 | 1 | 61,095 | 1 | 31,295 | 2 | 16,000 | 1 | * | - | * | - |
| Total operating expenses | 1,467,299 | 28 | 1,935,062 | 24 | 597,260 | 30 | 566,650 | 20 | 404,819 | 37 | 111,684 | 41 |
| Total expenses | 5,190,854 | 100 | 8,162,053 | 100 | 2,003,626 | 100 | 2,815,170 | 100 | 1,101,380 | 100 | 269,879 | 100 |
| Salaries: Operating expenses | 59:41 | | 71:29 | | 61:39 | | 77:23 | | 62:38 | | 59:41 | |

* Details difficult to partition

neg. Negligible

Table 7.4: Pattern of Deployment of Recurrent Funds for Agricultural and Livestock Research

| Category | Agric. & Livestock Research (MOALD) | | | | Kenya Agric. Research Institute (KARI) | | | |
|---|---|---|---|---|---|---|---|---|
| | 1979/80 | | 1984/85 | | 1979/80 | | 1984/85 | |
| | Amount(K£) | % | Amount(K£) | % | Amount(K£) | % | Amount(K£) | % |
| 1. Salary and allowances | 1,837,690 | 54 | 4,443,140 | 77 | 893,598 | 54 | 1,896,510 | 79 |
| 2. Capital investment | 373,228 | 11 | 96,240 | 2 | 241,972 | 15 | 55,000 | 2 |
| 3. Transport | 229,400 | 9 | 358,176 | 6 | 103,312 | 6 | 115,000 | 5 |
| 4. Training | 46,388 | 1 | 63,000 | 1 | 10,878 | neg. | 1,200 | neg. |
| 5. Experiment Station | 797,801 | 23 | 777,497 | 13 | 382,665 | 23 | 325,943 | 13 |
| 6. Miscellaneous | 49,045 | 1 | 31,345 | neg. | 30,220 | 2 | 16,000 | 1 |
| 7. Total operating Expenses | 1,192,634 | 35 | 1,230,018 | 21 | 527,075 | 31 | 458,140 | 19 |
| 8. Total expenses | 3,403,552 | 100 | 5,769,398 | 100 | 1,662,645 | 100 | 2,409,650 | 100 |
| Salaries: Operating recurrent exp. | 61:39 | | 78:22 | | 63:37 | | 80:20 | |

neg. Negligible

The solution of this problem is not easy. Clearly, it is desirable that the research system should cut down on its recruitments. Continuation of past trends will be disastrous. Rather, it should pay much greater attention to upgrading the skill level of the personnel in the system by training its cadre for professional research careers. This needs a major policy change which the Mission fully supports. Secondly, it is committed to upgrading the salary levels. This will put even greater strain on its recurrent resources. Finally, it must rationalize, as advocated in this Report, its network of research stations, cutting down drastically on number and functions so that some slack generated in recurrent funds can be shared by the remaining (viable) stations. But all these will add to recurrent expenditure. Assuming a 20 percent increase in the salary component (to meet the requirements of an incentive-oriented salary structure, as proposed in the Scheme of Service under consideration for all research scientists) and a 65:30 ratio of salary and operating expenses, the total bill for maintaining the present system would come to about K£ 8 million. This indicates about 38 percent increase over the current level of recurrent expenditure, and may represent a necessary corrective measure and a desirable structural adjustment. In addition, other incentives, such as improvement in research center amenities and better station management, are needed to improve the overall research environment.

It is obvious that in modern day Kenya the research system cannot meet its financial obligations, even with a drastically rationalized and reduced network of stations, from the annual government allocations to MOALD. For the system to function productively, it requires initial increase in resources to take care of the implementation of a revised scheme of service conditions, its training requirements, and the rehabilitation of the reduced network of research stations and institutions. Subsequently it would require consistent and stable funding to enable it to implement priority programs of research for the different agro-ecological zones, farming conditions, and commodities/systems in the country. For these types of research which are directly relevant to the agricultural industry in Kenya, the system should be able to draw on support from the agricultural business sector.

In the present and foreseeable economic circumstances of Kenya one cannot expect Government to substantially increase the proportion of direct financial resources allocated to agricultural research. The Mission, after reviewing the possibilities of such support with several officials in Kenya, came to the conclusion that with some imaginative and positive policy guidance and decisions it should be possible for the agricultural industry to support national agricultural research, at least in part. It is therefore suggested that, in line with the support which both CRF and TRF are receiving from the industry, general agricultural research be considered for support from the food and fibre production sectors. For example, cesses levied on each bag of maize and beans produced and marketed through the National Maize and Produce Board and elsewhere, or on bags of hybrid maize seed, cotton, or on sugarcane, livestock products, etc., should be able to provide substantial funds to support agricultural research. After all, these production systems have benefited and continue to benefit from improved materials and technologies generated by public-sector agricultural research. Funds generated by such cesses could be used to finance ongoing programs of research while annual government allocations in the budget are used to maintain research infrastructure and pay personnel costs. Details of these provisions should be worked out by MOALD and the reorganized KARI, in consultation with agricultural industry.

It is important to point out that several countries have practiced such a support system for agricultural research with considerable degrees of success, e.g. India, Thailand, Nigeria (cocoa), etc. Even within Kenya, CRF and TRF have eloquently proved the cost-effectiveness of this approach by their productivity and responsiveness to industries which support them through cesses. It also has the advantage of identifying public-sector research work with the agricultural industry and of making the researchers feel responsible to the clients, as it should be in applied agricultural research for development.

Although Kenya will be expected to demonstrate commitment and mobilize support for agricultural research in-country, the scale of the problems of rehabilitating agricultural research centers, organizing training for over 75 percent of current staff, and financing operating costs for sharply focused priority research programs will require more resources than can be mobilized internally. Donor assistance will be required in the medium and probably long term and on sustained bases in these critical areas of development. It is recommended, therefore, that Kenya should seek assistance for concerted and coordinated support from major donors that have shown interest and commitment to supporting Kenya's agricultural research development.

## 7.2 Resource Allocation

Some studies have been undertaken on resource allocation in Kenya's agriculture in the last ten years (Jamieson, 1981)[1]; Wang'ati (1981)[2]. These show some concentration on applied research and on medium- to high-potential areas of production, with some limited response to economic, social, and political inducements for change. An analysis based on some of these earlier studies is presented in Table 7.5. It should be noted that the data pertain to 1979-80 and do not fully reflect the current situation. It does provide a rough indication, however.

Table 7.5 reveals that tea and coffee together receive nearly one-third of national research resources, and nearly one-fifth goes to livestock research. Maize appears to receive less attention than it deserves. Relatively high allocations to oil and fibre crops and perhaps horticulture are probably in response to foreign exchange conservation and requirements. External aid (in 1979-80) was not involved in major projects in maize or wheat. They seem to have favored the livestock sector, coffee, and horticulture. The high proportions allocated to other food crops suggest some diversification of technical support. The overall picture appears to convey a reasonable response to factors like relative importance of commodities and foreign exchange concerns.

---

1) Jamieson, B.M. (1981). Resource allocation to agricultural research in Kenya from 1963 to 1978. Ph.D. Thesis, Toronto University.

2) Wang'ati, F.J. (1981). Allocation of resources to agricultural research. Mimeo. Nairobi.

Table 7.5: Proportion of research funds allocated to different commodities

| Commodity | % of research expenditure to commodities (1979-1980) | | | % of total production value (1981) |
|---|---|---|---|---|
| | GOK Funds | External Aid | Total Research Funds | |
| Coffee | 29 | 13 | 27 | 10 |
| Tea | 6 | - | 5 | 8 |
| Maize | 9 | 3 | 8 | 19 |
| Wheat | 2 | - | 1 | 3 |
| Sugar | 4 | - | 4 | 4 |
| Other food crops | 12 | 39 | 16 | n.a. |
| Oil and fibre crops | 9 | 5 | 8 | 2 |
| Horticulture | 8 | 9 | 8 | n.a. |
| Livestock (excl. range) | 17 | 23 | 18 | 33[1] |
| Range | 4 | 8 | 4 | |

[1] Excluding hides and skins

Source: Adapted from Mukunya, D.M., 1983.

Due to rising population pressure, cultivation is being extended to marginal zones. These have special problems and need research support. Historically, the research system has catered for the high- and medium-potential areas. There was little agricultural research outside these zones. It would seem that the changed circumstances have not substantially influenced the current allocation pattern over different zones. Table 7.6 attempts to show the proportion of research resources (funds and manpower) allocated to different zones. It is based on data from 24 major research stations and should convey a representative idea.

The table reveals that more than 90 percent of funds and scientific manpower is concentrated on the high- and medium-potential areas. High concentration of resources in the medium-potential zone probably signifies the efforts during the last decade to shift resources to these areas. Jamieson's work reveals that the high-potential zones were the most favored ones in the early 1960s. It is also important to note that the bulk of resources going to low-potential areas covers livestock and range research and not food crop production. These trends reveal that the agricultural research system has been quite responsive to changes in the structure of agricultural production over time but perhaps not sufficiently. It should also be noted that concentration in the medium-potential zone is largely a reflection of the dominance of Nairobi - particularly NAL and KARI. These institutions do not really have a zonal mandate, and if these are excluded, the dominance of the high-potential zone would be more pronounced.

Table 7.6: Allocations of Expenditure and Scientific Manpower by Zones: 1983-84

| Zones[1] | % Allocation of total research resources | | % Allocation of SRD resources | |
|---|---|---|---|---|
| | Funds | Scientists | Funds | Scientists |
| High-potential | 28 | 21 | 5 | 15 |
| Medium-potential | 66 | 71 | 88 | 76 |
| Low-potential | 6 | 8 | 7 | 9 |

1) High-potential zone covers zones 1 and 2; Medium-potential covers zones 3 and 4; and Low-potential covers zones 5 and 6.

Table 7.7 provides summarized infomation on the allocation of research resources to different research stations.

Table 7.7: Allocation of research resources to stations: 1983-84 (Based on data from 24 research stations)

| | Allocation of scientists | | Allocation of funds (annual) | | |
|---|---|---|---|---|---|
| No. of Scientists | No. of stations | % of total scientists | Research funds (K£'000) | No. of stations | % of total funds |
| Less than 10 | 11 | 12 | Less than 15 | 2 | 1 |
| 11 - 15 | 3 | 8 | 15 - 30 | 10 | 17 |
| 16 - 20 | 3 | 12 | 30 - 50 | 3 | 9 |
| More than 20 | 7 | 68 | More than 50 | 9 | 73 |

Table 7.7 clearly reveals the presence of a significant number of very small research stations. If 15 scientists are considered as constituting a critical mass, 14 out of 24 stations do not have a critical mass. These employ more than 80 scientists, and this resource needs redeployment. Also, more than two-thirds of the scientists are concentrated in seven research stations. Similarly, 73 percent of the research budget of the scientific research division is spent on nine stations - there are 12 others which take only 20 percent of the budget. This table reveals a basic structural problem in the research system, which has clearly spread its resources too thinly. This further supports the need for rationalization of the network of research stations, keeping in view the research priorities and also the concept of a minimum critical mass of staff

## 7.3 Funding at Research Stations

Table 7.8 presents the data for operating expenses per scientist at selected research stations. These reveal wide variations between stations - ranging from K£ 783 at Njoro to K£ 4213 at Kakamega and K£ 19,277 at the CRF.

This variation itself is cause for concern, even though one expects a range to cover specialized research areas. It is desirable to establish some kind of norm below which operating expenses per scientist should not go if the scientist is to be productive. Ideally, funding should be determined by needs of particular programs and projects, and such details should be worked out on the basis of the recommendations on rationalization of research centers and the nationally coordinated programs. The figures for the two autonomous research foundations, CRF and TRF, suggest that operating capital support for the Ministry research stations is extremely poor and too variable for any expectation of comparable research productivity.

Table 7.8: Operating Expenses per Scientist[1] at Selected Research Stations: 1983-84

| Research Station | Total Operating expenses (83-84) K£ | No. of researchers | Operating Expense per scientist K£ |
|---|---|---|---|
| 1. National Agricultural Laboratories, Nairobi | 119,700 | 91 | 1,315 |
| 2. National Plant Breeding Station, Njoro | 32,873 | 42 | 783 |
| 3. National Agricultural Research Station, Kitale | 89,054 | 39 | 2,283 |
| 4. National Horticultural Research Station, Thika | 14,464 | 36 | 2,068 |
| 5. National Sugar Research Station, Kibos | 27,315 | 29 | 942 |
| 6. National Dryland Farming Research Station, Katumani | 80,234 | 28 | 2,865 |
| 7. National Seed Quality Control Station, Lanet | 84,990 | 21 | 4,047 |
| 8. Coast Agricultural Research Station, Mtwapa | 35,626 | 16 | 2,227 |
| 9. Western Agricultural Research Station, Kakamega[2] | 58,988 | 14 | 4,213 |
| 10. National Potato Research Station, Tigoni | 32,028 | 11 | 2,911 |
| 11. Mwea-Tebere Agricultural Research Station | 49,225 | 16 | 3,076 |
| 12. Tea Research Foundation, Kericho | 111,684 | 12 | 9,307 |
| 13. Coffee Research Foundation, Ruiru | 404,819 | 21 | 19,277 |

[1] There could be some underestimation in operating expense per scientist because budget estimates are for 1983 1984, and the number of scientists is based on counts in September 1984.

[2] Includes Agricultural Research Station, Alupe.

Table 7.2 conveyed the impression that research expenditures were steadily rising, but this is not reflected in station allocations. At several stations during the Mission's visit, the problem of instability of funding was mentioned. In Table 7.9 we show the fluctuations in recurrent grants to selected research stations over the last five years. This table fails to reveal any consistant trend in recurrent expenditures over time. At no station does one observe a steady trend; there are in fact large swings between years. (Tigoni is an exception, as it seems to have a steady decline over the period). This obviously has had adverse effects on research, because once an approved research program has been initiated, there must be stability of funding for its duration. It is not surprising, therefore, that many experiments are being conducted in a highly ad hoc manner, with many not pursued to the point of fruition. The scientific research division must ensure that the required stability in recurrent funding is assured.

## 7.4 Summary

In summary, the funding of agricultural research shows serious deficiencies in the areas of:

(i) balance between personnel costs and operating costs;
(ii) adequacy for the scale and scope of operations;
(iii) allocation of resources with reference to the relevance of research in the national development programs;
(iv) adequacy of support for individual scientists to engage in productive research;
(v) stability of funding for research programs and stations.

It is therefore recommended that both short term and long term measures be taken to correct these deficiencies. In the short term, GOK should provide or seek assistance to increase resources to agricultural research to enable it to finance its incentive-oriented scheme of service, the training of existing personnel, the rehabilitation of the research centers and institutions, and the pursuit of consistent client-focused research programs. This would require increasing the level of allocation to about 2 percent of the agricultural GDP. In the medium term, adequate, consistent, and stable levels of resources should be provided to support the revised programs of research and the research center network. In the next few years, recruitment should be reduced as far as possible and emphasis placed on upgrading the quality and research orientation of the existing staff and in redeploying them for productive research at the recommended national and regional research centers.

Table 7.9: Instability in Recurrent Funding at Selected Research Stations

| Research Station | % Change in recurrent expenditure from previous year | | | |
|---|---|---|---|---|
| | 80-81/79-80 | 81-82/80-81 | 82-83/81-82 | 83-84/82-83 |
| 1. National Agricultural Laboratories, Nairobi | (-) 4 | (+) 4 | (-) 14 | (+) 31 |
| 2. National Plant Breeding Station, Njoro | n.a. | n.a. | n.a. | n.a. |
| 3. National Agricultural Research Station, Kitale | (+) 45 | (-) 17 | (+) 7 | (+) 36 |
| 4. National Horticultural Research Station, Thika | (-) 5 | (-) 59 | (+) 143 | (-) 6 |
| 5. National Sugar Research Station, Kibos | (+) 582* | (+) 26 | (-) 29 | (-) 34 |
| 6. National Dryland Farming Research Station, Katumani | (+) 39 | (+) 16 | (-) 16 | (-) 20 |
| 7. National Seed Quality Research Service, Lanet | (+) 18 | (-) 13 | (-) 10 | (+) 17 |
| 8. Coast Agricultural Research Station, Mtwapa | (-) 9 | (-) 48 | (+) 98 | (-) 48 |
| 9. Western Agricultural Research Station, Kakamega | (-) 27 | (+) 6 | (+) 99 | (-) 3 |
| 10. National Potato Research Station, Tigoni | (-) 13 | (-) 10 | (-) 4 | (-) 24 |
| 11. Mwea Tebere Agricultural Research Station | (+) 4 | (-) 43 | (+) 48 | (+) 12 |

n.a. = data not available

* Major World Bank assistance.

# CHAPTER 8: RESEARCH/EXTENSION LINKAGES

## Introduction

Agriculture in Kenya grew at the impressive rate of 4.6% per annum in the period 1964-72, thanks to the rapid adoption by smallholders of tea, coffee, dairying, and hybrid maize. With the intrusion of smallholders into new areas, the annual growth rate fell to 2% in the period 1972-78. The production of foodcrops stagnated in 1979, and Kenya has had to import considerable quantities of food to feed its fast-growing population since then.

The 1981 National Food Policy Paper estimated that the production of major food crops would need to grow at annual rates of 10% and more to attain self sufficiency by the end of the 1980s. These targets will not be easily achieved, since there is not much new land available any more, and yield increases similar to those obtained through the introduction of hybrid maize are not likely to be attained. There is, however, considerable scope for increased productivity in both food and export crops.

Since the large-scale farming sector has become less important, the country has had to rely on the further intensification of smallholder agriculture to realize some of these production targets. It will first of all be necessary to fully understand what farmers and their families are doing now and why they do it, and how the impact of recommended new technologies is likely to affect the farmer and his family. This is a joint function of the research and extension services.

Increasing agricultural productivity on small farms is a complex activity which requires collaborative efforts by the Government and private sector services, such as research, extension, input supply, credit and marketing. These efforts must also be combined with the necessary price incentives. The extension sector of these collaborative efforts in Kenya takes place mainly through:

(i) the Ministry of Agriculture and Livestock Development, involving:

- extension personnel at the district and provincial levels
- the Farmers' Training Centers (FTCs) in the districts
- the Agricultural Information Center (AIC), which has the national mandate to produce and disseminate educational materials by print, radio, and film,

detailed information on the organization of the MOALD extension services are provided in Volume II of the Report,

(ii) the parastatal Boards, such as the Coffee Board, Tea Board, and National Irrigation Board, which train the field personnel in the promotion of new recommendations and husbandry practices among farmers,

(iii) the national and regional research stations and laboratories, which produce handouts and guidelines on farming techniques for distribution on field days or national agricultural shows; they also train extension personnel in courses at the station or at monthly workshops at FTCs in the national Training and Visit Extension Scheme (T&V),

(iv) private companies such as Kenya Canners (pineapples), Kenya Breweries (barley, paw-paw), BAT (tobacco), Hortiequip (French beans for export); these companies supply inputs and provide instructions on proper husbandry techniques, etc.;

(v) the missionary groups which assist in different facets of rural development, e.g. crop production organization, the introduction of animal traction, and improved ox-implements.

The value to Kenya's farmers of the extension programs and services of the above-mentioned bodies depend on: the existence of sound, adoptable recommendations on farming techniques; the efficiency of the network of trained personnel; and effective communication means to spread the information among farmers.

Current Status of the Quality of Educational Material for Extension

The information on appropriate and improved farming techniques for Kenya can be obtained mainly from the technical handbooks produced by the AIC, handouts and circulars from the research stations and Boards, and the lecture notes of station researchers used for training workshops and courses. Private companies provide husbandry instructions and recommendations for their specific crops. Radio programs and other audiovisual presentations in English and Ki-Swahili are organized by AIC and the Coffee Board.

In general, it can be said that the sharper the focus on a single crop, and the tighter the organization of production and marketing of a commodity, the more valid and effective the recommendations on crop husbandry are likely to be. Thus, the recommendations for the tea or coffee grower, the contract-grower of French beans, or the tobacco grower, are usually adequate and site specific, generating large yield increases and improved incomes. The situation is different for foodcrops such as the traditional grains, pulses, tuber crops, green bananas, and for livestock; which by their very nature and production systems (except for hybrid maize and commercial wheat production) do not receive such sharp focus and therefore suffer from limited or lack of major impact of improved applied technological packages.

Some Shortcomings of Extension Material in Foodcrops and Livestock Production

A few weaknesses of the existing instruction materials of the Extension and Research Divisions of MOALD were observed by the Mission. These were as follows:

- The nature of text and presentation is frequently too academic or too general, written by a researcher rather than by a good extension educator or farm manager.

- Research results are usually not simplified or translated into straightforward recommendations on how, when and what to do.

- Recommendations are seldom site-specific; e.g. recommendations for plant density and fertilizer application seem to vary widely in similar agro-ecological zones and on similar soils.

- Grassroot messages to be used in the weekly courses for farmers in the FTCs are inadequate or almost lacking. Training at FTCs is too formal and classroom oriented; simple illustrative or demonstrative material is mostly not available.

- Messages from research stations are mostly developed for high-potential areas, where farmers' husbandry practices are more or less well-established. Very limited valid recommendations exist for the newly settled areas in the marginal and semi-arid regions, where good advice on crop and livestock production is most required. In fact, the danger exists that inappropriate recommendations may be disseminated in such regions.

Improvement in the Standards and Relevance of Extension Material

In the light of the observed weaknesses in the present research/extension linkages and extension materials, the Mission recommends that:

- Research efforts should be devoted to relevant subjects identified as genuine farmer constraints by diagnostic surveys carried out in the different agro-ecological zones. To carry out these surveys and provide effective organizational and field liaison with extension, it is recommended that an Agricultural Extension/Research Liaison and Communication Department (AERLC) be created within the reorganized KARI. This department will be comparable to the one existing within the CRF and will be a suitable model for strengthening research/extension linkages. This department should integrate the Agricultural Information Center (AIC) and the Kenya Agricultural Documentation Center into an effective extension, research, communication and information service. In addition to headquarters staff of subject-matter, communication, and information specialists, it should have assigned agronomists and subject-matter specialists who will function as integral parts of the farming systems and on-farm research teams at RRCs. The work of the AERLC Department should be organized and coordinated by the Assistant Directorate RRCs as proposed in Figure 9.1. The position and relationships of the AERLC are schematically illustrated in Figure 8.1 and emphasize the need for it to interact with national, regional, and parastatals research centers as well as in training, information, and demonstrations right down to the level of farmers. The diagnostic surveys to be undertaken by the unit, and in cooperation with RRCs, should be carried out by agricultural economists, farm managers, farming systems economists, and agronomists to ensure that constraints are seen from both managerial and production systems points of view, rather than from a purely technical angle.

- Research efforts of any well-defined program or project should be coordinated and headed by a Project Coordinator. This is to avoid the generation of conflicting recommendations and the duplication of research and extension efforts, and to ensure that trials are laid out at the appropriate locations or zones.

- Formal and informal contacts between researchers of national and regional centers and extension personnel of divisional, district, and provincial levels in T&V workshops should be continued and strengthened. Even if the logistics of these workshops ask for a less frequent encounter than a monthly workshop, the courses on specific subjects, as being held at research stations, should not entirely replace the regional T&V workshops in the districts. Research officers of the stations should carefully record the criticisms and feedback as generated during such workshops and associated field trips, to be able to provide relevant research subjects when preparing the annual work program proposal. As far as possible the choice of subjects should be more in consultation with the AERLC Department and the on-farm research teams at RRCs and NRCs.

- Arrangements be made to involve the communication and information specialists from AERLC to translate and simplify the outcome of field trials into advisory messages and recommendations for farmers and target groups at different levels, e.g., contact farmers in the T&V scheme, farmers at FTCs, and extension officers at the division or district levels.

- Provision should be made for improved facilities for researchers and AERLC personnel to use the AIC, the FTCs, and other appropriate channels to produce and disseminate the latest research results nationwide.

- Provision should be made for simple on-farm trials or pre-extension trials, in the different agro-ecological zones, by RRC on-farm research teams in close cooperation with the AERLC department. The farm trials should be as simple as possible, without replications (the farmer's sites act as replications), and should preferably be farmer managed. The diamond trials, as carried out on hybrid maize in the 1960s, are a good model for these field trials. Centrally edited guidelines on the layout and monitoring of the trials, with strong inputs from a biometrician and the relevant coordinator, will be necessary.

Extension Network in Kenya: Personnel and Communication Channels

The successful linkages between research and the farmer through extension personnel in Kenya parastatals, such as the Coffee or Tea Boards, are widely reported and extensively cited in the world literature. Successes are also known from companies, such as BAT and Hortiequip, where adaptive research, inputs supply, and extension are all centrally organized and focused on the production of a crop or commodity. Research in food crop and livestock production is undertaken by the public sector through MOALD and KARI, and should focus on many smallholders throughout the nation. This is often more problematic, even where an extensive network of extension centers and personnel exists, as is the case in Kenya. The three legs of the Kenyan extension apparatus of MOALD, the extension services at the district level, the FTCs and the AIC, can only perform well if support from other services and industries are strong and fully integrated. Such integration is provided for by the recommended reorganization suggested in Chapter 9, with provisions for strengthening research/extension linkages through the creation of an AERLC and the incorporation of research/extension linkage, on-farm research and training in the mandates of RRCs and in the terms of reference of the Assistant Directorate RRCs.

The Training & Visit Extension Scheme of MOALD

MOALD, aware of some of the weaknesses of its extension services, decided in the early 1980s to introduce the Training & Visit (T&V) extension model, as conceptualized by Mr. Benor and widely adopted by the World Bank, as a successful extension formula for developing nations. The general thrust of the T&V extension system is the strengthening of research/extension linkages through a disciplined, systematic scheme of farm visits and the regular training of field extension workers on relevant topics. Funding of the Kenyan T&V scheme is mainly through a World Bank loan to the Kenyan Government. The T&V system was started in a few pioneer districts in Western Kenya in 1982 and, after some successes were recorded there, it is now firmly establishing itself in the majority of the Kenyan districts of importance in national agricultural and livestock production. The systematic and disciplined approach involved in this scheme has certainly made its impact: researchers from the stations and extension officers from the districts discuss regularly at monthly workshops and current research findings are passed on without delay to the frontline extension workers. The regular visits of these frontline workers to their contact farmers should ensure that new technologies are passed on to contact farmers, other farmers associated with them, and the farming community in general.

It is recommended that in order to maintain consistency and effectiveness in the operation of the T&V scheme and the overall impact of improved technologies in agricultural production, serious attempts should be made to:

- deploy extension staff and other frontline workers for a long enough time to be familiar with the farmers and problems of particular areas,
- motivate research scientists to provide up-to-date and relevant improved technology recommendations from collaborative on-farm work with extension,
- stimulate and encourage the training of all levels of research and extension personnel,
- involve local authorities in the selection of contact farmers and in general extension,
- encourage the systematic and independent monitoring and evaluation of extension schemes and the generation of feedback from farmers,
- further develop the collation and utilization of practical teaching cases and examples from Kenya.

The consistent implementation of these measures requires close collaboration between extension and research, with the ultimate beneficiary being the Kenya farmer.

## CHAPTER 9: PLAN FOR REORGANIZING THE KENYA AGRICULTURAL RESEARCH INSTITUTE

The Mission, after intensive discussions and deliberations with government officials, policy makers, scientific personnel at all levels, other supporters of the research system, and users of the products of research, reached the conclusion that the key to desired improved organization and management of research lies in the reorganization and integration of KARI into the overall research system. The plan which is presented in this chapter therefore addresses that issue as a critical factor requiring urgent attention and support at both the ministerial and higher levels of government.

The GOK, in recognition of the need to re-focus research on the urgent development problems of the country, took a significant step in the reorganization of scientific research (including agricultural research) in 1979 by promulgating the Science and Technology Act, Chapter 250 of the Laws of Kenya. The Mission believes that the spirit and intention of that Act was to place agricultural research on a sound, semi-autonomous footing so as to enable it to perform its research functions of planning, organization, and management effectively, under a set of policy guidelines to be provided by the responsible Ministry of Agriculture and the Board of Management. This spirit and intention of the Act are as valid today as they were in 1979. Unfortunately, KARI Muguga, which was created from the former EAAFRO and EAVRO, has for various reasons been unable to fulfil this function and for all practical purposes has failed to develop into a national research organization responding to the needs of MOALD, of farmers, and the development process.

The Mission strongly feels that the state of affairs whereby KARI Muguga and the SRD of MOALD carry out aspects of the research function with little or no coordination and with varying levels of ineffectiveness does not make for the most effective utilization of resources and should not be allowed to continue. It is particularly important that this should not continue in the context of a unified Ministry of Agriculture and Livestock Development. The Act should be used to correct and strengthen the situation.

The Mission recommends that, in accordance with the provisions of the Act, the Minister of Agriculture and Livestock Development should as a matter of urgency reorganize KARI Muguga and integrate it fully with the SRD and livestock/veterinary research in the Ministry. The reorganized KARI should be firmly established within the Ministry, with its Directorate located in Kilimo House, or nearby, and should be responsive and advisory on all research matters to both the Permanent Secretary, the Director of Agriculture, Director of Veterinary Services, and through them, to the Minister of Agriculture and Livestock Development.

The implementation of this recommendation would involve the dissociation of KARI Directorate from a specific research station (Muguga) and bring research, as it should be, into the mainstream of planning, problem-solving and agricultural development. Decisions will also have to be taken on the designation of effective leadership within the recommended structure.

Previous Page Blank

It is recommended that such a reorganized KARI should be allowed to retain or sustain semi-autonomy in its operations and functioning and not merely be converted into a ministerial department. This provision, which is guaranteed under the Act, is important in ensuring that it could operate flexibly and efficiently in the scientific tradition. It should, however, see itself and operate as the essential research arm of the Ministry, addressing the priority research problems as identified by the Ministry or jointly with the other departments of the Ministry and the agricultural industry. It should operate under the policy guidelines generally provided by the Ministry and in accordance with the realities of the resource situation in the Ministry and the Government.

The Board

A second major step in the reorganization of KARI and integration of the research services is for the Minister to reconstitute the Board of Management. The responsibility for guidance of the reorganized KARI should be vested in the Board, which the Mission recommends should be constituted largely of the major users of the research end products - MOALD, the farming community, the agricultural industry, and the agricultural institutions.

The Board should be guided to evolve sound national research policy guidelines, foster research planning and programming, and ensure the orientation of research activities to national development goals. The Board should be a policy-making and advisory body; the executive functioning and supervision of research being left to the Directorate and the Research Centers.

The functions of the Board and the Institute provided under Sections 14 and 16 of the Act are comprehensive and adequate for them to function in accordance with the recommendations above and therefore need no expansion.

Composition

The Mission considers it important that in order to ensure that the Board and the reorganized Institute are responsible and responsive to the Ministry and to the development goals of the nation and the agricultural industry, the Board should be made up of people knowledgeable in government policies and objectives and who are consumers or transmitters of research results on behalf of government and the national agricultural industry. The Mission therefore suggests that the composition of such a Board should include:

the Permanent Secretary MOALD; the Director of Agriculture MOALD; the Director of Veterinary Services MOALD; the Director of Extension Services MOALD; the Assistant Director (Planning) MOALD - the Deputy Secretary (Finance); the Director of Planning - Ministry of Finance & Planning; the Secretary of NCST; the Principal of the College of Agriculture & Veterinary Medicine, Univ. of Nairobi; the Principal of Egerton College, Njoro; representatives of the participating Ministries under the Act; a representative of Kenya Grain Growers Cooperative Union (KGGCU); a representative of the agribusiness sector; a representative of the Agricultural Development Corporation (ADC); a knowledgeable farmer; and the Director of the reorganized KARI (as ex officio member and Secretary to the Board).

It is proposed that the Board will initially have three committees:

(i) a Research and Technical Committee to examine and review current and proposed research programs and projects;

(ii) a Finance and Administration Committee to oxamine the capital and recurrent budget proposals and program and project costs and estimates, and to attend to other administrative and financial policy matters on behalf of the Board;

(iii) a Manpower Development and Training Committee to review, consider, and coordinate manpower development and training proposals of personnel for agricultural research.

It should be ensured that the Board adheres to all the provisions of the Act and in particular the provision that the Board should meet not less than three times a calendar year. The preparation of the documentation for the Board and its committees should be undertaken by the Directorate and its headquarters staff.

Structure of the Reorganized KARI

The reorganized KARI should have responsibility for the planning, organization, and management of agricultural research undertaken in the Ministry's research centers, and for the coordination of national agricultural research efforts.

The proposals for the rationalization and reorganization of the research centers network are presented in Chapter 4, but for clarity of the organizational structure envisaged, the following organigram (Figure (9.1) presents the structure recommended for the reorganized KARI.

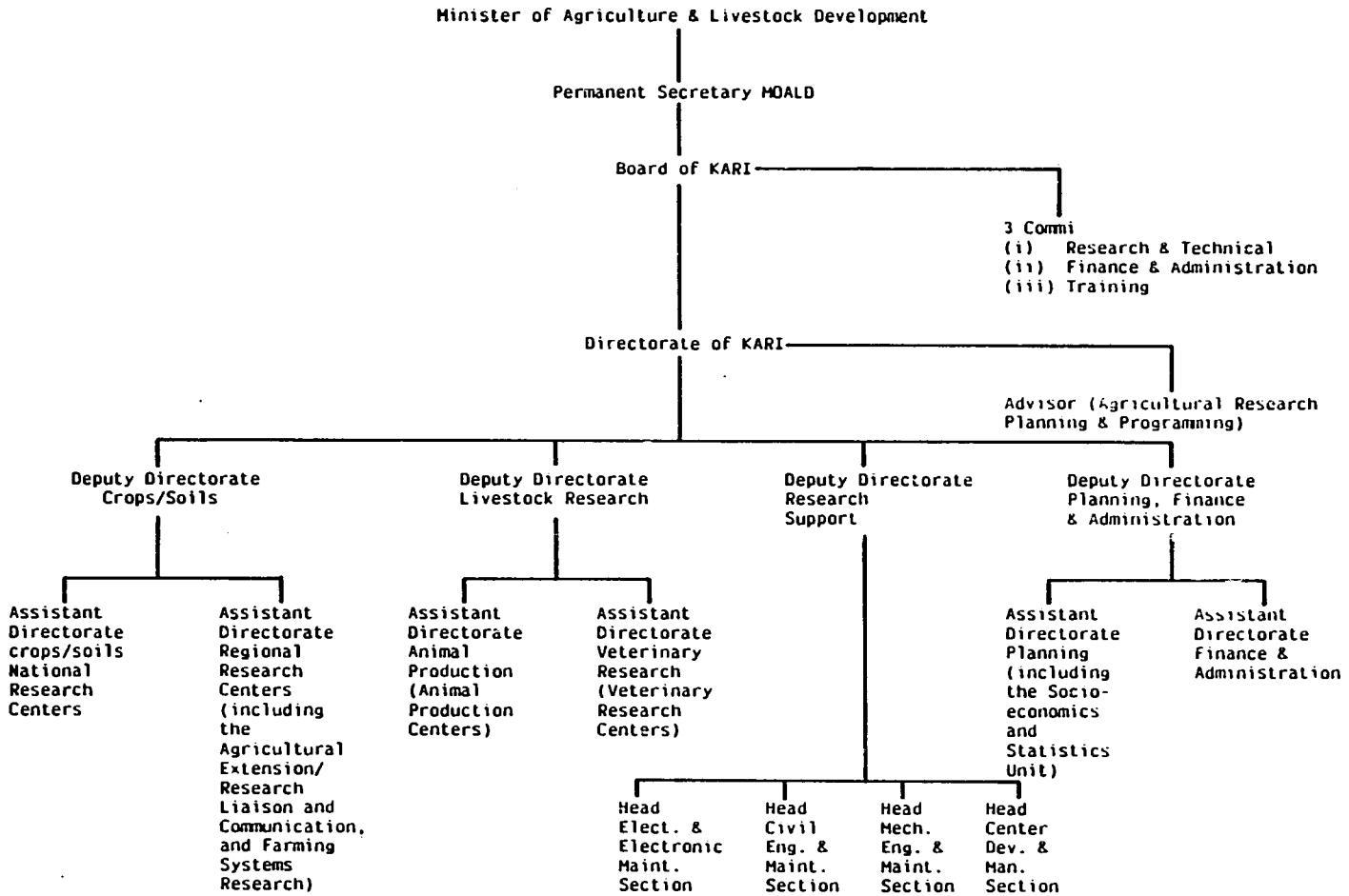
The lines in the organigram are lines of responsibility; the specific functions of individual officers from the level of Director below will be defined by the Board and the Management.

The Mission considered various other alternatives and options to upgrade, integrate, and strengthen the agricultural research system, including the following:

(i) The strengthening of SRD within the Department of Agriculture, with some degree of flexibility and semi-autonomy granted to it in its planning, organization, and management of research. This was not considered feasible in the context of the principles and practice of the civil service which govern the functions and operations within the Department of Agriculture.

(ii) The elevation of agricultural research within the Ministry by the creation of a Department of Agricultural Research and the granting of semi-autonomy and flexibility to the new Department, so as to enable it to organize, plan, and manage research in the manner in which a scientific research institution should be managed, for effective utilization of resources and research productivity. This was also not considered feasible in the context of a civil service department within the Ministry.

Figure 9.1: Recommended structure for a reorganized KAR:



(iii) The creation of a new Research Organization (Kenya Agricultural and Livestock Research Organization - KALRO) into which both SRD and KARI, Muguga would be integrated. Such an organization would be semi-autonomous (parastatal), with flexibility to plan, organize and manage research, but would be closely related and responsible to MOALD. This option was considered feasible and appropriate but would require specific actions by the Minister of Agriculture & Livestock Development, in consultation with the Ministry responsible for economic planning and the NCST, under the law. It may also require some amendments to the Science & Technology Act of 1979, which can only be done by Parliament. This option was rejected because it was felt that the urgently necessary process of the reorganization of research might be bogged down in these consultations and procedures.

(iv) The creation of an Agricultural Research Foundation, similar to the Tea and Coffee Research Foundations, into which research of SRD and at Muguga would be integrated. Kenya already has some favorable experience with Research Foundations in the sharply focussed, responsive and productive research of the Tea and Coffee Research Foundations. These foundations are largely supported by Government-levied cesses in the production and marketing of the two commodities. This option was also considered feasible but requiring independent actions, or actions under the Science & Technology Act, to create such a foundation and amend the schedules relating to institutes, which must be integrated into it to make it a comprehensive national agricultural research foundation. In view of this, the option was considered less desirable.

On balance, it was considered most appropriate to recommend, as above, the reorganization of KARI and integration of Muguga, as the National Agricultural Research Center into an overall national research system that would be semi-autonomous in its functioning but closely related and responsible to MOALD, which will give it direction, directly influence its growth and relationships, and keep it constantly focused on and relevant to the agricultural development process.

The Mission apppreciates that the reorganization of KARI and the integration of SRD and KARI, Muguga, and other livestock and veterinary research to constitute a national agricultural research system will not in itself provide for the expertise and orientation necessary for effective planning, organization, management, and direction of the research programs and projects identified and proposed in this Report. There is need to strengthen the expertise in the directorate to enable it to establish and consolidate the mechanisms for the planning, supervision, monitoring, and evaluation of research. In the long term, attempts should be made to identify and train leaders of the system in agricultural research management, and to systematize the practice of improved management at all levels in the system. <u>In the short term the Mission recommends that Kenya should seek assistance, from an appropriate and knowledgeable international research organization or agency, for an agricultural research planning and programming advisor to the Directorate for a period of 3 - 4 years</u>. The advisor, under the supervision of the Director, and in close collaboration with the operational divisions and departments of MOALD, could appropriately be assigned the following tasks and responsibilities:

(i) to assist in designing a system of planning, programming, monitoring, and evaluation of the research activities of the Institute;

(ii) to be the principal advisor to the Director of the Institute for setting up a national system for the planning, management, and evaluation of research which integrates the research activities taking place in other development projects, institutions and the private sector with those of the Institute;

(iii) to establish a system of information gathering for assessing and evaluating research, and to design a communication and reporting system;

(iv) to analyze the information collected, including the non-quantifiable aspects of the research effort, and transmit these analyses and the ensuing recommendations to the Director of the Institute and heads of relevant divisions/departments of MOALD;

(v) in collaboration with department/division heads and other senior officers, to evaluate the results of research;

(vi) to assist the divisions/departments in preparing annual scientific reports and other scientific and technical reports;

(vii) to participate in the periodic preparation and review of the master plan for agricultural research in Kenya;

(viii) to participate in the training of personnel in the fields of planning, management, and evaluation of research;

(ix) to participate in the preparation of donor-assisted agricultural research projects, especially as regards the programming of the research activities of the Institute and MOALD.

It is suggested that the research planning and programming advisor should have the following qualifications and experience:

- a university higher degree in agriculture, animal production or related field,

- a minimum of 10 years of experience in the planning, programming, monitoring, and evaluation of agricultural research or development,

- a good knowledge of the English language.

## Summary of Major Recommendations

1. The Mission recommends two main types of research center: (a) National Research Centers (NRCs) and (b) Regional Research Centers (RRCs), and there would be no distinction in status between them. It was proposed that there should be 13 NRCs (12 if the National Sugar Research Center at Kibos was constituted as a Sugar Research Foundation) and 6 RRCs.

2. The NRCs would cover technology generation in first-priority crop commodities, factors, and livestock, while research teams at the RRCs would be multidisciplinary, with a strong focus on adaptive and problem-solving research. All NRCs would also have small units of farming systems research cooperating with RRCs in on-farm research.

3. In general, only RRCs would have sub-centers, reflecting recognizable diversity in the broad agro-ecological zone represented by each.

4. Both types of center will be provided with clear and specific mandates, and research coordination could be conducted from either type of research center. (See Annex IV).

5. Coordinated research programs will comprise a national coordination center and a number of cooperating centers. The coordination center will normally be at a NRC and the cooperating centers at RRCs. The coordination center will be headed by a project coordinator, a senior scientist capable of providing specific program leadership.

6. There will be coordinated research programs for all priority crops, livestock, and commodities, that transcend regional boundaries and are of national significance and importance.

7. A workshop would be held at least once a year, when responsibilities for different aspects of coordinated research programs would be defined as would recommendations on release of information on new technologies for farmers. The Project Coordinator would also organize training programs for junior scientists and prepare reports for the Director.

8. A national farming systems research program is proposed, with bases in RRCs and coordination by the Assistant Director Regional Research.

9. That GOK should request assistance for a major manpower and training development program to upgrade both scientific and research support staff over the period of the next 10 years.

10. That GOK should seek assistance to increase resources to agricultural research: this should be concerted and coordinated support from major donors that have shown interest and commitment to supporting Kenya's agricultural research development.

11. That GOK should explore ways of generating additional internal resources for adequate and stable funding of agricultural research.

12. That, in accordance with the provisions of the Act (Chapter 250), MOALD should, as a matter of urgency, integrate KARI, Muguga fully with the SRD to constitute a reorganized KARI.

13. A reorganized KARI should be allowed to retain or sustain semi-autonomy in its operations and functions and not merely be converted into a ministerial department.

14. That the KARI Board should be constituted largely of the major users of the research end products, MOALD, the farming community, the agricultural industry, and the agricultural education institutions.

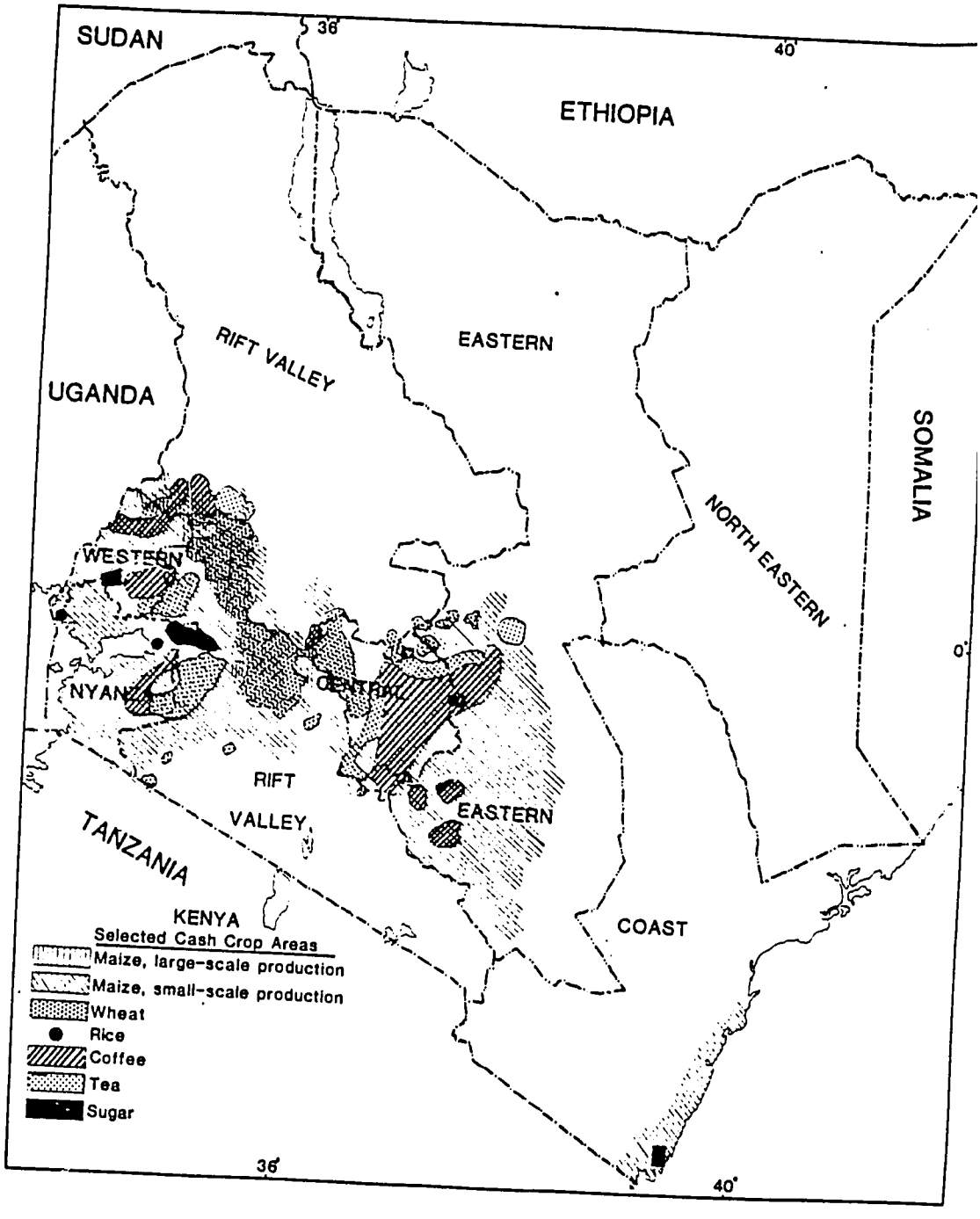
15. That research/extension linkages be strengthened by the creation of an Agricultural Extension Research Liaison and Communication Department within the reorganized KARI. This department should integrate the Agricultural Information Centre and the Kenya Agricultural Documentation Centre into an effective extension research, communication, and information service.

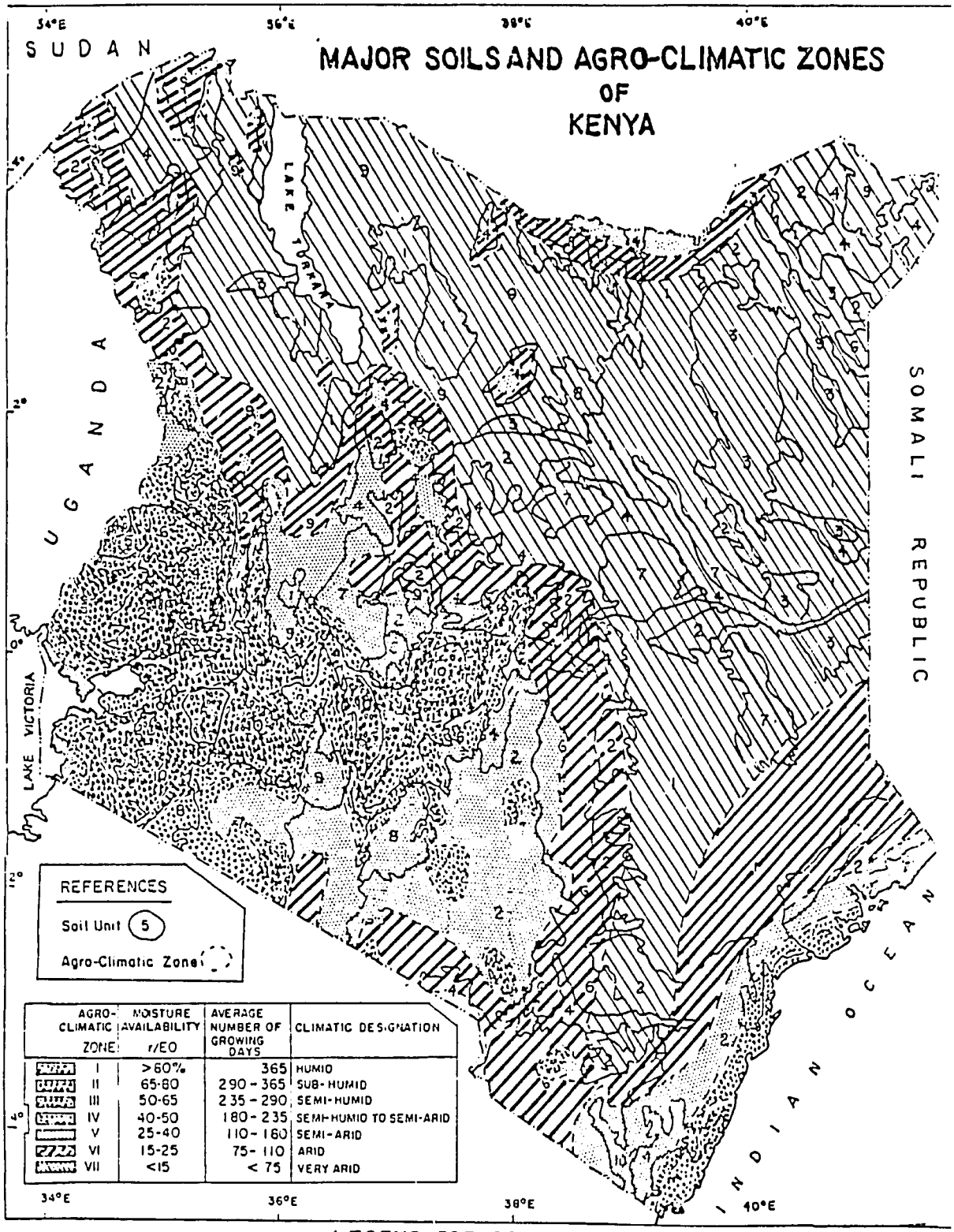
16. In the short term, Kenya should seek assistance from an appropriate and knowledgeable international research organization or agency for an agricultural research planning and programming advisor to the Directorate for a period of 3 to 4 years.

17. That a new research center in Irrigation and Drainage be established to develop the country's potential for crop and animal production through irrigation and drainage and the management of problem soils.

ANNEX I

Major Crop Production Zones of Kenya



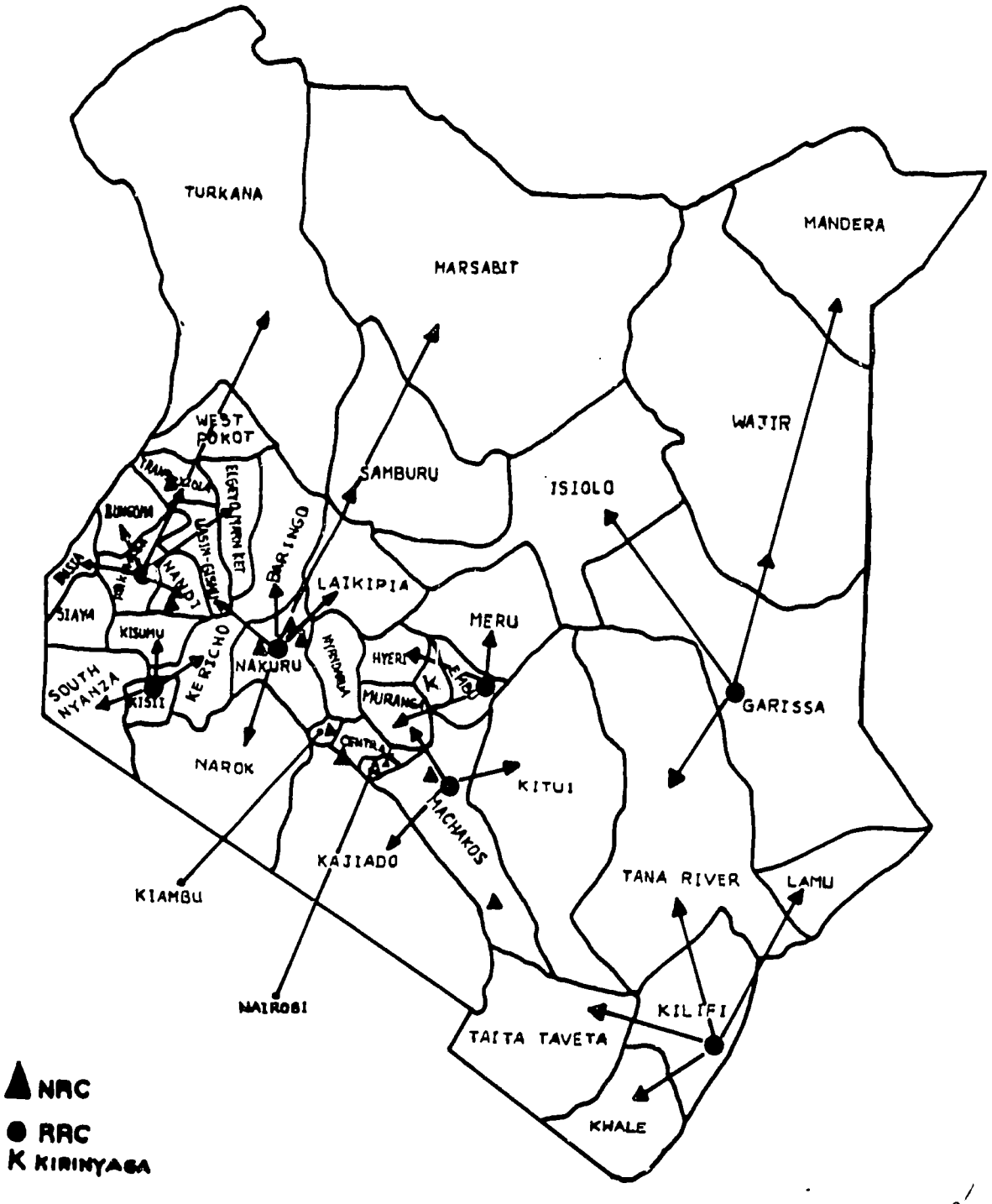



## LEGEND FOR SOILS

1. Solonchak and Solonetz (Saline & Alkaline Soils)
2. Acrisols and Luvisols.
3. Arenosols. (Sandy Soils)
4. Cambisols, Fluvisols & Gleysols.
5. Nitisols.
6. Ferralsols.
7. Planosols & Phaeozems.
8. Vertisols (Black Soils)
9. Regosols and Xerosols.
10. Andosols, Histosols & Greyzems.

ANNEX III

Recommended Agricultural Research Centers and Districts of Kenya (District Focus)



ANNEX IV

## MANDATE OF RESEARCH CENTERS

As indicated in Chapters 4 and 5, the mandates of the existing research centers are rather diffuse and do not provide positive guidance for program organization and implementation. In order to sharpen the overall research focus and strategy, the following mandates are proposed for the rationalized network of national and regional research centers as presented in those chapters.

### National Research Centers

#### National Maize and Pasture Research Center - Kitale

Commodity : Maize

1. Correlate the maize research program to the development planning of the country for maize production. Based on this correlation, develop a short-, medium- and long-term perspective of maize research, keeping it in line with the country's needs. Assist the planners and policy makers in arriving at a more realistic type of development strategy.

2. Make a careful assessment of the different agro-ecological zones, including the smaller pockets distributed in different areas which offer a potential for maize production. Characterize and quantify these regions in terms of high, medium, and low production potential, taking into consideration the natural endowment of soils, patterns and amount of rainfall, temperature and humidity regimes, opportunity costs in relation to other crops, and social factors. Also, take into consideration the policy decisions of government with regard to priorities for different crops.

3. Based on the above, define clearly the technological support which maize production for different major agro-climatic regions and minor production situations would require. This should include an assessment of the types of maize varieties needed (hybrids, composites, open-pollinated varieties), with their durations, grain quality characteristics, plant height, and other plant type characteristics.

4. Define clearly the objectives in terms of crop yields on the basis of climatic factors and the agronomic management to be recommended to different groups of farmers.

5. Plan the breeding methodology and other supporting research on a multi-disciplinary basis, with major emphasis on high levels of productivity, combined with more efficient use of costly farm inputs like chemical fertilizers and pesticides. Plan to substitute non-renewable inputs with those of a renewable kind as much as possible. For example, integrated pest management could help to save on the use of chemical pesticides. Similarly, intercropping of maize with short-duration legumes may help to save on nitrogen fertilizers. Stability of performance over a wide range of agronomic regimes should be an overriding objective.

6. Review worldwide information on maize improvement and management, production technologies, and materials specially relevant to Kenya. Establish close relationships with CIMMYT and IITA to ensure continued flow of new germplasm and concepts into Kenya's national maize program. A collection of genetic resources of maize from within the country and from outside must be maintained as a working collection, and a more complete germplasm collection should be stored at the Muguga gene bank.

7. Develop new experimental approaches to fit maize into a series of cropping systems in order to maximize overall production through more intensive land use. Also, place emphasis on per-day productivity rather than absolute crop yields.

8. Resolve the total research activity of the Center and collaborating stations into well-defined programs, projects, and experiments, indicating the time frame for each, with built-in stages of review by the research committee, after three years, five years, and ten years. The review should provide for continuation of a project in its present form, in a modified form, or for its termination based on the progress made. Evolve more regular monitoring procedures for the research projects by the director and the staff.

9. Develop close linkages with the regional centers and the extension service for adaptive testing of improved materials in different agro-ecological zones and on farmers' fields. Develop close collaboration with regional stations for joint programs.

10. Organize production of breeders' seeds of the recommended varieties and develop close linkages with the Kenya Seed Company to assist in the national seed production program through its various cycles.

11. Review the laboratory and field research infrastructure, consistent with the needs of research work and use this information for the purpose of budgeting and for the preparation of plan proposals.

Pasture Research

1. Help to evolve a sense of strong scientific direction to the country's programs on fodder and pasture research. Redefine the objectives of this research, correlating it closely to animal production and help to promote the concept that fodder yields are not to be measured in terms of tonnage alone. Total dry matter production per hectare and per unit of time are important, but much of this dry matter may be of little use unless it contributes to animal production.

2. Based on the above concept, define more clearly the yield parameters of fodder crops in terms of dry matter production, palatability and digestibility, energy and protein content. Develop simple laboratory and field procedures for estimation of these parameters.

3. Make a careful assessment of potential fodder resources of Kenya in the different agro-ecological zones as part of the exercise to evolve suitable resource strategies. These resources would include the high-value fodder crops in more favorable lands with irrigation or assured rainfall, rainfed lands of medium potential which suffer from prolonged dry spells, and arid lands subject to extreme moisture stress.

115

4. Formulate and organize a national program corresponding to each of the three situations indicated above.

5. Evaluate the existing germplasm and new introductions of grasses and legumes for their ability to do well under these diverse conditions. The evaluation should take into consideration adaptation, ability to produce large amounts of dry matter, and high-value nutrients for animal production. Concentrate in this way on a few selected species for each of the different agro-ecological conditions. For example, in the more favorable areas, lucerne and oats may do well, while in the relatively arid zones, Panicum and Pennisetum species and some of the native grasses and legumes may perform better.

6. Organize a major thrust in introducing legumes, as much as possible, into Kenya's fodder production programs. This should ensure balanced animal nutrition and improved soil fertility.

7. Organize a program of introduction and testing of fodder legumes under different agricultural conditions. Develop in this effort close linkages with the Australian and the CIAT programs on pasture improvement through grass-legume mixtures.

8. Identify improved fodder species for stall feeding and grazing pastures. The cultivated fodder varieties should be selected for a reasonable balance between vegetative vigor and the ability to produce [illegible] seed or other planting materials for propagation purposes.

9. Organize agronomic research to evolve suitable fertilization practices, optimum mixtures of grasses and legumes, sowing dates, management of irrigation, including its intensity and frequency. Evolve a year-round calendar for continued availabity of fodder, based on a judicious selection of short-duration varieties.

10. Develop fodder conservation practices for lean periods and devise techniques for the utilization of crop residues, either through enrichment with chemicals or through recycling.

National Wheat and Oil Seeds Research Center, Njoro

1. Prepare a perspective plan with regard to the place of wheat in Kenya's agriculture, especially in the context of the present popularity of the maize crop. The adoption of maize as the staple food of Kenyans during the last 30 years is a major development but should be seen as part of an evolving process of social and economic development. The development of maize may represent the first step towards a dietary pattern change which will take Kenyans even closer to the western societies. If this happens, wheat will come to occupy a particularly important place in Kenya's agriculture. The main requirement at present is to determine how important this place could be and what is the expected time frame for a signficant shift, if any, to wheat in Kenya's diet. There may be no simple answer to these questions, but the scientists have the responsibility to keep analyzing potential trends of this nature in consultation with the planners.

2. Make a careful survey of the different agro-ecological zones, including fairly well-defined pockets in some of them, where wheat cultivation appears to offer a particularly great potential. Consider for this purpose the natural factors of soil fertility, rainfall, temperature range, etc., and also the comparative situation of wheat in relation to other crops, including its marketability. Quantify the results of these surveys, which should end up in a map of potential wheat districts of Kenya.

3. Make a careful assessment of the present wheat varieties recommended to farmers in Kenya - analyze their favorable and not-so-favorable characteristics. Wheat production in recent years has seen a breakthrough with the development and widespread distribution of dwarf varieties, carrying the Norin-10 genes. Some of these varieties with a high harvest index of 40-45 percent can give a yield of 6 tonnes of grains per hectare in a relatively short period of five months. Carefully analyze the adoption of this strategy for Kenya so that many of the traditional varieties with their low harvest index, longer maturity duration, and relative susceptibility to diseases could be replaced. The dwarf varieties in general may not show as good grain quality as the traditional tall types, but their vastly increased yields should override this consideration, especially if they are also disease resistant. The first approach should be to go for high yields and disease resistance and then try to improve grain quality.

4. Organize a quality testing program for the new wheat germplasm, giving special attention to protein content and amino acid balance, including a high lysine content, and testing for physical quality of the dough for baking, chapatti, and biscuit making.

5. Develop agronomic practices specially designed for small farmers, whose numbers can be expected to increase in the coming years, taking care at the same time for the technology needs of large farmers. Pay special attention to critical sowing dates, keeping in view temperature conditions and moisture availability; critical stages of irrigation (or moisture conservation practices in non-irrigated lands); and balanced applications of chemical fertilizers.

6. Emphasize varieties which are more stable in performance and at the same time respond well to improved levels of agronomic management.

7. Treating wheat as one component of a cropping system, develop suitable cropping sequences and combinations and other production schemes in which wheat could be fitted by manipulating it maturity period and some of the other characteristics. Thus, in highly favorable areas with assured irrigation, wheat can be fitted into an intensive production program using a 2- or 3- crop rotation.

8. Develop a national strategy for the control and management of wheat diseases. Start with the survey of the important pathogens and classify them in some order of priority based on an estimation of the losses which they cause. The more important pathogens, such as the wheat rusts, should receive greater attention. Organize a monitoring service for prevalence of rust races on farmers' fields, maintain all the races and pure cultures, using a series of different screen houses. Provide support to plant breeders in the resistance breeding program by supplying inoculum of rust races for artificial field infection. Similar support has to be created for other diseases.

9. Develop a national strategy of containing threats of disease epidemics by diversifying the high-yielding varieties program. While it may be necessary in the initial stages to cover large areas with a single high-yielding variety, the strategy should be to distribute a number of them in time and in space.

10. Develop inter-institutional collaboration with CIMMYT and some of the other national programs for exchange of germplasm to use this introduced material more and more in local breeding programs rather than as direct selections.

11. Collaborate with the regional research centers for adaptive research for those parts of the country which cannot be directly reached with material evolved at Njoro.

Oilseed Crops

1. Closely interacting with the planning departments of the responsible ministries, help to evolve a national strategy for oilseed production in which research can be fitted more meaningfully. (Kenya at present does not have a long-term plan of this kind). Provide, and if necessary, generate data for this purpose in respect of adaptability and performance of the more important oilseed crops; their potential for area coverage and production; their relative yields and their relative economics of production and marketing. The analysis should help to determine research/production strategies for the different oilseed crops.

2. Clearly identify agro-ecological zones and areas of comparative advantage for different oilseed crops. This consideration should include the traditional crops, like sunflower, safflower, rapeseed, soybean, and castor, but also others, like groundnut and sesame. The wide range of environmental and ecological conditions should make it possible to grow crops like sunflower and safflower in very dry lands, and soybean and groundnut in better parts of the country.

3. Pay special attention to soybean as a potentially important multi-purpose oilseed crop, helping to meet dietary fat and protein requirements in human food and animal feed.

4. Start with development of improved germplasm in all the different oilseed crops through a major program of introduction with international institutions like ICRISAT, IBPGR, INTSOY, and some of the national programs, followed by rapid evaluation in multilocation performance trials all over the country.

5. Develop appropriate breeding methodology for each of the major oilseed crops. For example, sunflower hybrids are now being released which help to solve the problem of seed sterility and deterioration. New plant types in rapeseed-mustard have been developed in recent years in the Indian programs. The INTSOY program in the U.S.A. is an important source of improving soybean varieties for spring, summer, and winter seasons. New plant types in castor, characterized by early maturity and a dwarf plant type are also beginning to be developed.

6. Evolve an effective plant protection technology, as oilseed crops suffer from serious insect and disease losses. An integrated pest and disease management strategy should be stressed, including seed treatment, as in groundnut.

7. Collaborate with the National Soil and Water Management Research Center in developing effective moisture conservation practices for the different oilseed crops. These crops, in general, are adapted to low water requirements which could be met under dryland conditions through efficient soil and water management.

8. Evolve a productive technology of oilseed crops, with major emphasis on intercropping and multicropping, using short-duration varieties and new plant types to fit in specific crop geometry.

9. Develop, through adaptive, applied, and on-farm research, improved varieties of wheat, sunflower, safflower, and other oilseed crops for recommendation to farmers in the region.

10. Develop, through field experiments, packages of agronomic practices for the recommended varieties, stressing high response to improved management and relative stability of performance.

11. Develop, around suitable varieties of different crops and breeds of animals, diversified production systems, emphasizing maximization of returns on investment, greater productivity per day, greater opportunity for employment generation, and stability of yields consistent with environmental security.

12. Undertake an economic analysis of the existing and improved farming practices, and demonstrate these to farmers and extension personnel.

13. Evolve an effective system of scientific communication with the national and international research centers so as to create a regular channel for the flow of new and improved materials, technologies, and concepts for testing, improvement, and incorporation in the recommended practices.

National Potato Research Center, Tigoni

1. Help to define clearly, through perspective planning and close collaboration with the concerned government departments, the place of potatoes in Kenya's agriculture. Take into consideration the fact that the potato, as a relatively new crop in world agriculture, with the first introduction to Europe and Asia only about 200 years ago, has seen phenomenal success. It owes its success to a high food value in calories, protein content, excellent storage and cooking qualities, wide acceptance as food by a large number of people, and its relatively high levels of productivity under a wide range of conditions. The indications are that 50 years from now the potato will be a far more important crop in world agriculture than it is today, and its popularity will spread to all the continents, including Africa, where it is expected to become.

2. Place on a systematic basis the varietal introduction and improvement program, identifying for Kenya the clones which are best adapted and most acceptable to people. Select from a wide range of variability for earliness, preference, and resistance to diseases.

3. Organize a Kenyan potato improvement program based on a well-conceived crossing scheme, using some of the leading varieties of the world which show adaptation to Kenyan conditions and local varieties of proven merit and quality characteristics.

4. Organize a strong integrated program with responsibilities assigned to geneticists, plant pathologists, entomologists, and soil scientists.

5. Evolve suitable techniques of seed production, identifying for this purpose the locations and seasons which are relatively free of insect pests, nematodes, and diseases.

6. Develop the production technology of potato, making it a component of different cropping systems.

7. Multiply virus-free seeds, using virus indexing technique for meeting the needs of the commercial seed production agencies.

8. Organize a quality-testing laboratory as a service function to breeders.

9. Develop long-term and regular contact with the International Potato Center in Peru for introduction of new germplasm, using tissue culture techniques to keep out viruses.

National Dryland Farming Research Center, Katumani (including soil/water management)

1. This reorganized research center should derive its mandate, keeping in view the following trends which should intensify in the years to come. In the context of the present and the anticipated population growth, Kenya would have a human population of about 30 million people in 2000 A.D. In order to feed this population, Kenya must increasingly extend its agriculture to the arid and semi-arid lands which account for over 70 % of the total land area, 20 % of the human population, 35 % of the cattle, and over two-thirds of sheep and goats in the country. More importantly, these lands play a crucial role as a major part of the watershed of the country, and their management would determine the extent of severity of drought and floods, the rate of erosion and siltation of streams, rivers, irrigation dams, and reservoirs. The reorganized center should therefore have its major focus in the field of soil and water management.

   (a) Develop techniques for rainfed farming and efficient rainwater management.

   (b) Identify crops, cropping systems, and sequences for efficient moisture utilization to increase and stabilize production per unit time and per unit area.

   (c) Evolve conservation farming techniques to increase in situ soil moisture conservation and storage and to reduce moisture stress during crop growth.

   (d) Evolve contingent plans to meet weather aberrations in order to minimize their effects.

129

(e) Appraise erosion problems for conservation of land and water resources under different land-use systems.

(f) Evaluate and identify suitable plant materials for different land uses according to land capability.

(g) Monitor changes in environment as affected by land-use and management practices.

(h) Evaluate hydrological behavior and management of watersheds for reducing sediment discharge and improving water regimes.

(i) Evolve improved crop varieties of cereals, pulses, grasses, and legumes which are adapted to low water requirement and which show a relatively stabilized performance under conditions of uncertain rainfall and moisture stress.

(j) Train soil and water conservation personnel at various levels, and with various backgrounds, so that the manpower resources for the development programs can be tackled effectively.

(k) Demonstrate through appropriate extension programs practices on soil and water conservation for improving production on farmers' land.

(l) Monitor environmental changes on farmers' holdings as affected by integrated watershed managment in operational research projects.

(m) Develop, through adaptive, applied, on-farm research, improved varieties of maize, sorghum, millet, pigeonpea, cowpea, and cotton for recommendation to farmers in the region.

(n) Develop, through field experiments, packages of agronomic practices for the recommended varieties, stressing high response to improved management, drought tolerance, and relative stability of performance with declining management regimes.

(o) Develop, around suitable varieties of different crops and breeds of animals, diversified production systems, emphasizing maximization of returns on investment, greater productivity per day, greater opportunity for employment generation, and stability of yields consistent with environmental security.

(p) Undertake an economic analysis of the existing and improved farming practices, and demonstrate these to farmers and extension personnel.

(q) Evolve an effective system of scientific communication with the national and international research centers so as to create a regular channel for the flow of new and improved materials, technologies, and concepts for testing, improvement, and incorporation in the recommended practices.

121

National Irrigation and Drainage Research Center, Ahero

The mandate of this new center would be based on the present emphasis which the government of Kenya attaches to the development of irrigation in the country and in response to the need to provide an integrated focus to studies in the field of irrigation and drainage.

1. Water Management:

   (a) Characterize the physical properties of red soils to understand factors causing high infiltration rate.

   (b) Design and evaluate both conventional and non-conventional irrigation systems, like sprinkler and drip irrigation, to reduce unproductive water losses and to increase irrigation efficiency.

   (c) Study the efficacy of various practices/materials in reducing deep percolation losses.

   (d) Find out the feasibility of storage of seepage water in valley lands and its recycling through pumping for irrigation.

   (e) Develop alternative cropping systems with low water requirement and high-value crops in the uplands, and excess-water-tolerant crops like rice in the bottom lands.

   (f) Determine water use by different crops in relation to fertilizer, and quantify nutrient losses under varying water regimes.

2. Drainage of Potential Agricultural Lands:

   (a) Plan, design, and execute drainage investigations.

   (b) Conduct hydrological surveys to provide suitable criteria for surface and subsurface drainage for reclamation of these problems soils.

   (c) Test drainage materials for effectiveness, durability, and economics.

   (d) Study the performance evaluation of different drainage systems.

   (e) Study the interrelationship of soil-water regimes and soil fertility aspects in these reclaimed soils.

   (f) Study the performance of different cropping systems under varying degrees of reclamation of waterlogged soils.

   (g) Develop technology for optimizing productivity of reclaimed soils.

3. Irrigation Water Management in Soils Threatened by Salinity:

   (a) Undertake survey and pedo-chemical characterization of the nature of soil salinity/alkalinity in the subsoil.

(b) Study salt and water dynamics in irrigated agriculture.

(c) Study the long-term effect of irrigation on level of water table and secondary salinization.

(d) Design and evaluate surface irrigation methods and other practices to reduce unproductive water losses and increase irrigation efficiency.

(e) Develop suitable cotton-based cropping systems for efficient use of irrigation water.

(f) Work out optimum agronomic and cultural practices, including irrigation and fertilizer schedules for different cropping systems.

(g) Design and evaluate subsurface drainage systems for regulating the rising trend in water table as well as to ensure leaching of salts.

4. Training and Data Bank:

(a) Impart training to junior scientific and technical staff in water management.

(b) Maintain data bank on available information on soil and water management in the country and make such information available to planners, researchers, and development agencies.

National Sugar Research Center, Kibos

1. Make a complete assessment of the available genetic variability in the clones reccommended for cultivation in different parts of the country, and use this information to diversify the genetic base of the sugarcane crop in Kenya. This would involve a planned program of introduction and evaluation of new clones in collaboration with Muguga.

2. Organize an efficient crop-improvement program with the following major objectives. Improvement of:

(a) Clones with varying range of maturity periods so as to extend the crushing season.

(b) Clones with increased sugar yields per day.

(c) Clones with higher sugar content.

(d) Clones combining high sugar yields with resistance to disease.

(e) Clones which are better adapted to intercropping systems.

(f) Clones responding favorably to varying levels of agronomic management, including those which do well in stress environments.

3. Develop agronomic packages for different farming conditions and agricultural situations. The stability of performance should receive special attention.

4. Develop crop protection measures against diseases and insect pests, using an integrated approach.

5. Evolve a cropping-system technology that will allow sugarcane to be grown with a number of different intercrops, especially short-duration legumes, and in different combinations.

6. Collaborate with appropriate institutes for reducing sugarcane yield losses in poorly drained soils.

7. Develop improved sugar technology.

8. Take sugarcane breeding from its present stage of adaptive research to applied research on the basis of a national hybridization program. Identify suitable sites for this purpose.

National Seed Quality Research Center, Lanet

1. Production and testing of breeders' seeds of recommended crop varieties and clones.

2. Standardization of techniques of seed testing and seed production.

3. Evolution of procedures for production of hybrid seeds of various crops, such as maize, sorghum, and millet.

4. Improvement of seed storage methods and physiological studies on seed dormancy.

5. Establishment of standards of seed viability and of genetic and physical purity, for crop varieties in respect of breeders' seed, foundation seed, and certified seed.

6. Development of fungicide and other chemical treatments for the production and supply of pathogen-free and pest-free seeds.

National Agricultural Research Center, Muguga

Crops

1. Organization of germplasm introduction of various crops into Kenya, following the internationally agreed procedures, practices, and precautions (African Phytosanitary Council).

2. Evaluation of introduced germplasm for agronomic and other traits for the purpose of distribution to various crop research centers.

3. Establishment and maintenance of germplasm storage facilities on a medium- and long-term basis. This will take the form of a national gene bank.

4. Organization of an international seed exchange unit.

5. Organization of exploration for and collection of useful germplasm within and outside Kenya.

6. Documentation of germplasm collections and dissemination of information to crop breeders throughout the country.

7. Organization of research in the field of microbiology, virology, plant pathology, and seed technology as a support service for the introduction program.

8. Setting up of a tissue-culture laboratory to take advantage of the more modern techniques of germplasm exchange.

Animal nutrition

1. Coordinate all ruminant nutrition investigational work in the country, including surveys of animal feed resources.

2. Review the laboratory and field facilities available for animal nutrition research at national and regional research centers and their utility and suitability for coordinated nutritional investigational programs. Advise as to any unnecessary duplication and of any additional facilities required for the successful operation of coordinated programs.

3. Organize a coordinated investigation to be conducted at appropriate regional and other centers to investigate how well the nutritional demands of grade milking cattle can be satisfied so that they express their full milking potential with and without the use of concentrates and/or byproduct feeds in:

   a) zero-grazing systems based on planted forages;
   b) semi-intensive systems based on ley and natural pastures in high-potential areas;
   c) extensive dairy ranching systems based on natural grazing in medium-potential areas.

4. Organize a coordinated investigation at appropriate research centers of the nutritional requirements of work oxen during the dry season and during work periods. Use the resulting data to provide extension staff with information on how farmers should feed and manage their work animals in different agro-ecological zones.

5. Organize a survey of the potential total production and availability of byproduct feeds in all agro-ecological zones and determine:

   a) their suitability for feeding to different classes of livestock;
   b) the districts in which it will be economic to use them;
   c) their safety as feeds.

6. Review the existing literature on mineral deficiencies in Kenyan livestock. Organize, in cooperation with the National Veterinary Research Laboratories, a survey of macro, minor, and true element deficiencies in grazing livestock, utilizing the information already available. This will require detailed analysis of animal tissues and body fluids and information on plant and soil analyses in those areas where the animals are managed; it should proceed district by district; with high-potential areas being surveyed first. The ultimate objective would be to provide information (including maps) of potential mineral deficiencies for livestock in all districts of the country.

7. Review world literature on the possibility of improving the digestibility (and hence the nutritional value) of roughage feeds, using physical, chemical, and microbiological techniques. Assess whether any existing techniques can be adapted for use in Kenya. Organize coordinated investigations of any technique previously considered promising in Kenya or thought possible to introduce in the Kenyan environment. Investigate at Muguga the possibility that some East African livestock from the driest areas may possess in their rumen organisms capable of digesting cellulose outside the rumen.

Animal physiology (acclimatization)

1. Coordinate and assist with all investigations concerned with the acclimatization of livestock to specific ecological conditions.

2. Review laboratory and field facilities for acclimatization work at Muguga and other appropriate research centers. Advise as to their suitability and as to whether additional facilities are required.

3. Investigate, in cooperation with Kiboko staff, the effects of stress on the productivity of range livestock and advise as to whether ameliorative managerial methods are practical.

4. Assist animal-breeding staff in the formulation and conduct of breeding programs designed to produce acclimatized and productive dairy cattle suitable for use in varied smallholder managerial systems throughout the country.

Veterinary research

1. Conduct the longer-term and more fundamental veterinary research programs that should be complementary to those undertaken by the National Veterinary Research Laboratories, Kabete, the international and commercial veterinary research organizations in Kenya. Priorities for these programs would be determined in part by the National Veterinary Research Laboratories, Kabete, in accordance with information generated by its Epidemiology and Economic Research Unit.

2. Continue and strengthen the research and service capability for the diagnosis and control of rinderpest and act under international auspices as a regional center under the Pan African Rinderpest campaign. The Rinderpest vaccine production capability to continue and to be funded on a more realistic independent basis.

3. Continue to investigate through experimentation and field trials methods for the control of theileriosis in co-operation with other Institutions.

4. Reappraise priorities for other research in the bacteriology, biochemistry, helminthology, protozoology, and virology sections to identify research opportunities in areas of major significance to the livestock keepers of Kenya. Such research to include the formulation of minimum animal health packages.

5. Act as the coordinating Institute for collaborative research, pilot and field trials with the National Animal Production Center at Naivashu and regional research centers and with private famers and ranchers in cooperation with the provincial Veterinary Investigation Laboratories. If necessary, collaborative programs could be conducted on an East African regional basis.

National Agricultural Research Laboratories, Nairobi

1. Incorporate the Kenya Soil Survey and extend its activities to land-use planning, with the following objectives:

   (a) Conduct of standard soil surveys, using different scale-base maps, and preparation of interpretive maps from the lowest administrative units to the country level.

   (b) Conduct of semi-detailed and detailed soil surveys in selected areas; viz. operational research projects, research center farms, University farms, dryland farming centers, etc., to suggest experiments for refining interpretation.

   (c) Conduct correlation studies to delineate important soils of the country at different category levels of soil classificaion and provide suitable legend for different types of soil surveys to maintain uniformity and technical excellence.

   (d) Preparation of land-resource maps at different scales.

   (e) Development of a rationale for modification and adoption of soil classification systems in the country.

   (f) Undertake soils-based and agro-climate-based, problem-oriented research projects to meet regional needs.

   (g) Identification of benchmark soils for pedological studies for better understanding of soil genesis to develop definitions and criteria for characterization and classification.

   (h) Use of remote-sensing techniques and other remote-sensing data products in soil surveys and interpretation.

   (i) Establishment of soil libraries, data banks, a soil museum, and a documentation center for research and extension.

   (j) Conduct need-based training in soil survey methods, classification, and interpretation for soil survey personnel.

   (k) Promote the use of soil maps for land-use planning by various user agencies and by training extension staff, field/research officers, etc.

   (l) Coordinate and supervise soil surveys conducted by different agencies for uniformity and nomenclature through correlation.

2. Organization of supporting soil scientific research for a more productive agriculture. Establish for this purpose a soil-fertility network with participation of national agricultural/horticultural research centers.

3. The main function of the network would be to determine critical limits of nutrients in soils and plants for determining fertilizer requirements of crops, nutrient management studies, through field experiments involving time, method, rates, and sources of fertilizer application, studies of nutrient economy through organic recycling, and introduction of bio-fertilization, characterization and amelioration of soil-based constraints to crop production, and studies of the effects of agro-chemicals, including fertilizers and pesticides, on soil environment and crop productivity.

4. Organize coordination of simple fertilizer trials at selected experiment stations and simple fertilizer experiments on cultivars.

5. Organize support services in the field of entomological and plant pathological research to support the various groups of agricultural scientists. This service would include the carrying out of national surveys on the prevalence and predominance of the more important insect pests and pathogens, maintenance of their culture collections, etc.

6. Organize an identification service and basic research in the field of plant pathology and entomology.

7. Establish a pesticide residue analysis service to ensure observance of regulations and safety measures in pesticide usage.

National Veterinary Research Laboratories - Kabete

1. Continue, in addition to its many essential service functions, a research capability in the more applied areas of diagnosis, survey, quality control, and health management planning.

2. Develop further the very important program of investigations into the epidemiology and economics of livestock disease in which surveys, disease monitoring, surveillance, and the evaluation of field implementation play important roles.

3. Organize research programs of a less applied nature in circumstances where there appear to be new and perhaps unique factors requiring investigation; assuming the availability of facilities and manpower.

National Animal Production Research Center - Naivasha

Animal breeding

1. Assist in the establishment and administration of the proposed National Animal Breeding Council and thus in the coordination of efforts to conserve and develop valuable indigenous and exotic breeds throughout the country.

2. Organize at appropriate centers the breeding of productive dairy cattle acclimatized to highland, semi-arid, and coastal environments.

3. Continue the existing breeding program for Sahiwal cattle and establish a herd of Small East African Zebu at Kiboko, with selection for milk production and liveweight gain.

4. Establish a Galla goat herd at Kiboko and a Blackhead Persian sheep flock at Buchuma, with selection for fertility and liveweight gain.

5. Organize the crossbreeding of temperate-type goats with Galla at Naivasha and Small East African at Molo, with selection of the crossbreds for hardiness and milk production.

6. Organize at Naivasha, in collaboration with all other interested organizations, the establishment of a central recording system for livestock data from all animal breeding programs sponsored by the National Animal Breeding Council.

Animal physiology (reproduction)

1. Investigation of infertility in all domestic species would be the overall mandate, but a first priority would be to survey the extent and causes of infertility in dairy cattle, in collaboration with the National Veterinary Research Laboratories.

2. A second priority program would be investigations as to whether the provision of AI or bulls from a local bull center would be the most suitable and economic method of satisfying the requirements of smallholders for cattle-breeding services.

Pig and poultry research

1. Continue the existing feeding and management programs in which problems are investigated on an ad hoc basis as they become apparent to producers and extension staff.

2. Extend investigations of the possibilities of using suitable byproduct feeds to provide economic and nutritionally balanced pig and poultry rations.

3. Introduce additional pig breeds, possibly Duroc and Hampshire, into the national pig-breeding program and continue the present breeding methods of importing boars from time to time, crossbreeding the imported boars with the existing pig population, and selecting the progeny for productivity.

National Range Research Center - Kiboko

1. Investigate the dynamics of all livestock systems in pastoral regions as a major priority. This will involve: the collection and continuous updating of data on domestic livestock and wildlife numbers in cooperation with KREMU; the collation of data on the mortality, fertility, growth, and milk production of all range livestock; the investigation of the disease and parasite situation in range livestock systems in cooperation with the Epidemiology and Economics Research Unit of the Kenyan Veterinary Research Laboratories, Kabete; breeding and management practices; and the level of nutrition that includes the dynamics of the rangeland vegetation complexes and viable long-term stocking rates.

2. Use all the data acquired in investigations of the pastoral livestock systems and any other information that may be available for the development of possible drought strategies that could ultimately be used by GOK for development purposes.

129

3. Investigate, in cooperation with the acclimatization physiologist at Muguga, the effects of stress (feed and water shortages and trekking long distances) on the productivity of range livestock.

4. Investigate under pastoral and ranching conditions the effects of grazing different proportions of range livestock together, with or without wildlife, on rangeland vegetation, overall stocking rates, and the long-term productivity of rangeland.

5. Utilize the data obtained in the above investigations to formulate viable long-term rangeland management strategies for all ranching areas and pastoral communities in Kenya.

6. Cooperate with the proposed National Animal Breeding Council in the establishment of national herds of Small East African Zebu cattle and Galla goats at Kiboko and a national flock of Blackhead Persian sheep at Buchuma.

National Horticultural Research Center, Thika

1. Define clearly, through perspective planning and close collaboration with the horticultural production and exporting industries, the place of fruits, vegetables, and other horticultural crops in Kenya's agricultural industry.

2. Establish and strengthen programs for varietal introduction, evaluation, improvement, and production in priority vegetables and fruits. Apply rigorous priority criteria in selecting vegetables and fruits for emphasis in the research program.

3. Organize a fruit and vegetable improvement program with a major focus on small-scale, intensive production and both internal and external markets.

4. Organize a strong integrated program of horticultural crop production systems, with responsibilities assigned to geneticists, plant pathologists, nematologists, entomologists, postharvest and food technologists.

5. Evolve suitable techniques for seed and planting material production and test such materials at cooperating centers in present and potential production areas.

6. Develop strong programs in pest and disease resistance screening and integrated pest and disease management in the major fruits and vegetables.

7. Develop and strengthen research on the improvement of vegetable-type beans and peas and collaborate with relevant research centers in investigations regarding their production systems.

8. Organize training at subprofessional and production levels for horticulturists in the public and private sectors of Kenya's horticulture industry.

9. Develop long-term and regular contact with international centers such as CIAT, IITA, and AVRDC, especially in respect to beans, vegetable cowpea, and major improved tropical and subtropical vegetables.

Note: Fruits and vegetables in the current research and development programs include avocado, bananas, passion fruit, apples, mango, macadamia, peaches, grapes, citrus, cabbage, carrot, green peppers, sweet peppers, onions, tomato, eggplant, red peppers (capsicums), green beans and peas, melon, cucumber, asparagus, beet root, chinese cabbage, mung beans and other Asian vegetables.

Regional Research Centers

1. Regional Research Center, Kakamega.

   (a) Develop, through adaptive, applied, and on-farm research, improved varieties of maize, beans, sunflower, cotton, pyrethrum, and fruits and vegetables for recommendation to farmers in the region.

   (b) Develop, through field experiments, packages of agronomic practices for the recommended varieties, stressing high response to improved management and relative stability of performance with declining management regimes.

   (c) Develop, around suitable varieties of different crops and breeds of animals, diversified production systems, emphasizing maximization of returns on investment, greater productivity per day, greater opportunity for employment generation, and stability of yields consistent with environmental security.

   (d) Undertake an economic analysis of the existing and improved farming practices and demonstrate these to farmers and extension personnel.

   (e) Evolve an effective system of scientific communication with the national and international resear h centers so as to create a regular channel for flow of new materials, technologies, and concepts for testing, improvement through adaptive research, and incorporation into recommended practices.

2. Regional Research Center, Kisii

   (a) Develop, through adaptive, applied, and on-farm research, improved varieties of sorghum, maize, groundnut, cotton, rainfed rice, cassava, and breeds of livestock for recommendation to farmers in the region.

   (b) Develop, through field experiments, packages of agronomic practices for the recommended varieties, stressing high response to improved management and relative stability of performance with declining management regimes.

(c) Develop, around suitable varieties of different crops and breeds of animals, diversified production systems, emphasizing maximization of returns to investment, greater daily productivity, greater opportunity for employment generation, and stability of yields consistent with environmental security.

(d) Undertake an economic analysis of the existing and improved farming practices on slopes and valley bottoms, and demonstrate these to farmers and extension personnel.

(e) Evolve an effective system of scientific communication with the national and international research centers so as to create a regular channel for flow of new materials, technologies, and concepts for testing, improvement, and incorporation into the recommended practices.

3. Regional Research Center, Embu

(a) Develop, through adaptive, applied, and on-farm research, improved varieties of maize, beans, pineapple, rice, cotton, and breeds of livestock for recommendation to farmers in the region.

(b) Develop, through field experiments, packages of agronomic practices for the recommended varieties, stressing high response to improved management and relative stability of performance with declining management regimes.

(c) Develop, around suitable varieties of different crops and breeds of animals, diversified production systems, emphasizing maximization of returns to investment, greater productivity per day, greater opportunity for employment generation, and stability of yields consistent with environmental security.

(d) Undertake an economic analysis of the existing and improved farming practices, and demonstrate these to farmers and extension personnel.

(e) Evolve an effective system of scientific communication with the national and international research centers so as to create a regular channel for the flow of new and improved materials, technologies, and concepts for testing, improvement, and incorporation into the recommended practices.

4. Regional Research Center, Garissa

(a) Develop, through adaptive, applied, and on-farm research, improved varieties of maize, sorghum, millet, pigeonpea, cowpea, rice, cotton, and breeds of livestock for recommendation to farmers in the region.

(b) Develop, through field experiments, packages of agronomic practices for the recommended varieties, stressing high response to improved management and relative stability of performance.

(c) Develop systems of irrigation and drainage for improved productivity in the north-eastern and eastern areas of the country.

- 132

(d) Develop, around suitable varieties of different crops and breeds of animals, diversified production systems, emphasizing maximization of returns to investment, greater productivity per day, greater opportunity for employment generation, and stability of yields consistent with environmental security.

(e) Undertake an economic analysis of the existing and improved farming practices, and demonstrate these to farmers and extension personnel.

(f) Evolve an effective system of scientific communication with the national and international research centers so as to create a regular channel for the flow of new and improved materials, technologies, and concepts for testing, improvement, and incorporation into the recommended practices.

5. Regional Research Center, Mtwapa.

(a) Develop, through adaptive, applied, and on-farm research, improved varieties of cashew, coconut, maize, cassava, cowpea, sesame, and breeds of livestock for recommendation to farmers in the region.

(b) Develop, through field experiments, packages of agronomic practices for the recommended varieties, stressing high response to improved management and relative stability of performance with declining management regimes.

(c) Develop, around suitable varieties of different crops and breeds of animals, diversified production systems, emphasizing maximization of returns to investment, greater productivity per day, greater opportunity for employment generation, and stability of yields consistent with environmental security.

(d) Undertake an economic analysis of the existing and improved farming practices, and demonstrate these to farmers and extension personnel.

(e) Evolve an effective system of scientific communication with the national and international research centers so as to create a regular channel for the flow of new and improved materials, technologies, and concepts for testing, improvement, and incorporation into the recommended practices.

6. Regional Research Center, Mwea-Tebere

(a) Develop, through adaptive, applied, and on-farm research, improved varieties of cotton, rice, and beans for recommendation to farmers in the surrounding districts.

(b) Develop, through field experiments, packages of agronomic and other production practices for the recommended varieties of major crops and other crops grown by farmers in the region, stressing high response to improved management, relative stability of performance, and increased productivity.

(c) Develop, around suitable varieties of different crops and breeds of animals, diversified production systems, emphasizing optimization of returns on investment, greater productivity per day, greater employment generation opportunity, and stability of yields consistent with environmental security.

(d) Undertake socio-economic analysis of the existing and improved farming practices and demonstrate these to farmers and extension personnel.

(e) Evolve effective systems of scientific communication with the national and international research centers so as to create a regular channel for flow of new materials, technologies, and concepts for testing, improvement through adaptive research, and incorporation in recommended practices.

(f) Collaborate with other national and regional research centers in the generation and testing of improved technologies.

ANNEX V

## CLASSIFICATION OF RESEARCH SUPPORT SERVICES

The manner in which Research Support Services are organized within a research institute/center, and the types of services required, depend on many factors, some of which are as follows:

1. The research mandates of the institute/center.
2. The judgement and experience of the management of the institute/center.
3. The history of the development of the institute/center.
4. The quantum and priority of funds.
5. Availability and capacity of local establishments.
6. The personalities and capacities of the staff providing the services, and of those utilizing the same.

Regardless of the types of services supporting research, either directly or indirectly, at a particular Institute and the way in which they are organized, they can be classified in five general categories as per the type of service they perform.

The classifications are:

1. Administrative Services.
2. Research Services.
3. Physical Plant Services.
4. Farm Operations.
5. Augmentation Services.

An expanded list of services within the five categories is presented below. The list is a summary of services, by categories, from numerous institutes. It is not representative of the services that may be found in any one institute, nor is it representative of the manner in which the services may be administratively organized.

### (A) ADMINISTRATIVE SERVICES

1. Institute Administration
2. Personnel
3. Purchasing
4. Inventory Management
5. Housing and Food Services
6. Safety and Fire
7. Travel, Domestic and International
8. Secretarial/Clerical
9. Finance
10. Stores
11. Transport (Staff and Goods)
12. Security (Vigilance)
13. Medical
14. Recreation Facilities

## (B) RESEARCH SERVICES

1. Laboratory (analytical)
   a. biochemistry
   b. electron microscope
   c. radioisotope
2. Library (documentation and computer search)
3. Controlled Env. Plant Growth Facilities
   a. glasshouses
   b. screenhouses
   c. growth chambers
4. Computer
5. Meteorology
6. Small Animal Services
7. Research and Tech. Assistants (working in research programs)
8. Genetic Resources (collection, identification, multiplication, storage and dissemination)
9. Plant Quarantine and Introduction
10. Field Chemical Laboratory
11. Statistics
12. Central Seed Stores

## (C) PHYSICAL PLANT SERVICES

1. Mech. Eng. & Maintenance
   a. farm tractors-equipment
   b. vehicles and aircraft
   c. machine shop
   d. fabrication shop
   e. R & D (Mechanical)
2. Electrical Eng. & Maintenance
   a. elec. equip. & installation
   b. power generation
   c. air conditioning
   d. R & D (elec. & A/c)
3. Civil Eng. & Maintenance
   a. carpentry
   b. masonry
   c. plumbing
   d. water & effluent treatment
   e. landscaping, development and maintenance
   f. janitorial
   g. building design const. and modifications
4. Electronic Engineering and Instrument Maintenance
   a. lab equipment
   b. office equipment
   c. communication and visual aids equipment
   d. R & D (electronic)

## (D) FARM OPERATIONS/SERVICES

1. Management Services
   a. land facilities allocation
   b. record keeping
   c. commercial

2. Planting and Fertilizer
   a. precision
   b. commercial

3. Seed Processing
   a. harvesting
   b. cleaning
   c. drying
   d. storage

4. Animal Services (livestock, husbandry and related services)

5. Labor Operations

6. Mechanical Operations
   a. plowing
   b. harrowing
   c. planting
   d. cultivating
   e. harvesting

7. Irrigation Application for:
   a. plant growth
   b. insect and disease prevention and screening

8. Plant Protection
   a. surveillance
   b. control
   c. farm chemical stores

9. Farm Development and Maintenance

## (E) AUGMENTATION SERVICES

1. Information Services
   a. Editing
   b. Language Interpretation
   c. Layout and Art
   d. Photography
   e. Printing and Binding

2. Training

3. Multiplication of Improved Materials

4. Extension Work

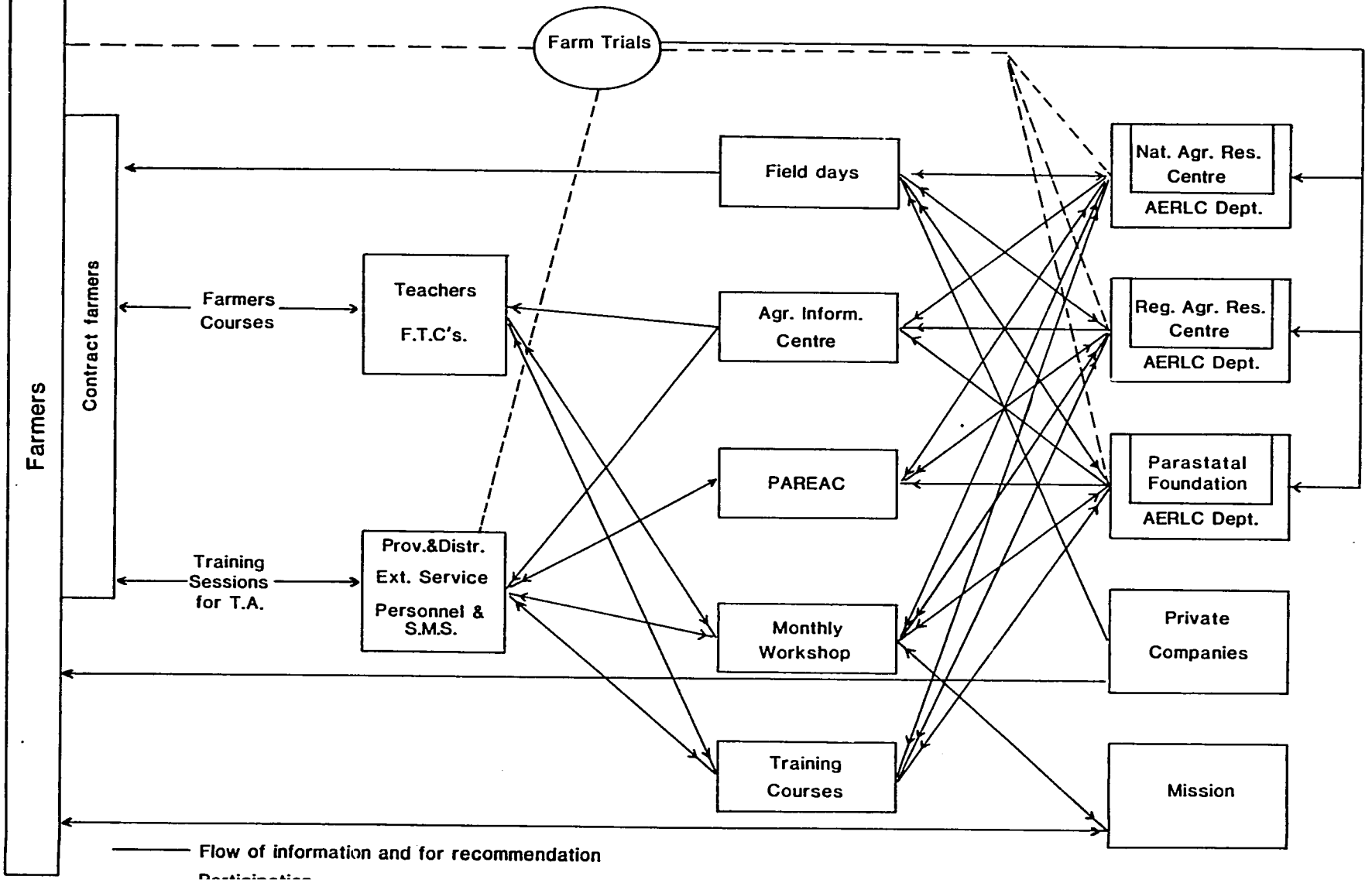
5. Visitors' Services

6. Liason with govt. and other bodies

7. Communication Services
   a. Postal
   b. Telegraph - Telex
   c. Telephone

137

## Suggested model for strengthening research / extension linkages



ANNEX VII

## EXTRACT FROM THE SCHEME OF SERVICE FOR RESEARCH POSTS IN KENYA

### List of Job Groups and Salary Scales

| | | | |
|---|---|---|---|
| 1. | Job Group RI.P | - | K£4,584X186-5,514 p.a. |
| 2. | Job Group RI.N | - | K£3,804X156-4,584X186-4,956 p.a. |
| 3. | Job Group RI.M | - | K£3,408X132-3,804X156-4,428 p.a. |
| 4. | Job Group RI.L | - | K£2,172X108-3,144X132-3,540 p.a. |
| 5. | Job Group RI.K | - | K£2,154X90-2,604X108-2,928 p.a. |
| 6. | Job Group RI.J | - | K£1,794X72-2,154X90-2,424 p.a. |
| 7. | Job Group RI.H | - | K£1,494X60-1,794X72-2,010 p.a. |
| 8. | Job Group RI.G | - | K£1,128X42-1,254X48-1,494X60-1,554 p.a. |
| 9. | Job Group RI.F | - | K£834X30-864X36-1,044X42-1,170 p.a. |
| 10. | Job Group RI.E | - | K£690X24-714X30-864X36-972 p.a. |
| 11. | Job Group RI.D | - | K£531X21-594X24-714X30-774 p.a. |
| 12. | Job Group RI.C | - | K£435X18-489X21-594X24-642 p.a. |
| 13. | Job Group RI.B | - | K£354X15-399X18-489X21-531 p.a. |
| 14. | Job Group RI.A | - | K£300X12-324X15-399X18-453 p.a. |

## Job Gradings

| | Designation | Job Group |
|---|---|---|
| 1. | Director | RI.P |
| 2. | Research Scientists | |
| | Chief Research Officer | RI.N |
| | Principal Research Officer | RI.M |
| | Senior Research Officer | RI.L |
| | Research Officer | RI.K |
| | Assistant Research Officer | RI.J |
| 3. | Administrative Cadre | |
| | Administrative Secretary | RI.M |
| | Principal Administrative Officer | RI.L |
| | Senior Administrative Officer | RI.K |
| | Administrative Officer I | RI.J |
| | Administrative Officer II | RI.H |
| | Administrative Assistant | RI.G |
| 4. | Accounts Cadre | |
| | Accounts Controller | RI.M |
| | Principal Accountant | RI.L |
| | Senior Accountant | RI.K |
| | Accountant I | RI.J |
| | Accountant II | RI.H |
| | Accounts Assistant | RI.G |
| 5. | Supplies Cadre | |
| | Chief Supplies Officer | RI.L |
| | Senior Supplies Officer | RI.K |
| | Supplies Officer I | RI.J |
| | Supplies Officer II | RI.H |
| | Supplies Assistant | RI.G |
| 6. | Laboratory Technologist | |
| | Chief Laboratory Technologist | RI.L |
| | Senior Laboratory Technologist | RI.K |
| | Laboratory Technologist I | RI.J |
| | Laboratory Technologist II | RI.H |
| | Laboratory Technologist III | RI.G |
| 7. | Laboratory Technicians | |
| | Senior Laboratory Technician | RI.G |
| | Laboratory Technician I | RI.F |
| | Laboratory Technician II | RI.E |
| | Laboratory Technician III | RI.D |
| 8. | Engineering Technicians | |
| | Senior Engineering Technician | RI.K |
| | Engineering Technician I | RI.J |
| | Engineering Technician II | RI.H |
| | Engineering Technician III | RI.G |

140

| Designation | Job Group |
|---|---|
| 9. Library/Documentation Cadre | |
| Senior Librarian/Documentalist | RI.K |
| Librarian/Documentalist I | RI.J |
| Librarian/Documentalist II | RI.H |
| Assistant Librarian | RI.G |
| Senior Library Assistant | RI.F |
| Library Assistant I | RI.E |
| Library Assistant II | RI.D |
| 10. Secretarial Cadre | |
| Personal Secretary I | RI.J |
| Personal Secretary II | RI.H |
| Stenographer I/Pool Supervisor | RI.G |
| Stenographer II | RI.F |
| Copy Typist I | RI.E |
| Copy Typists II | RI.D |
| 11. Clerical Cadre | |
| Senior Clerical Officer | RI.F |
| Higher Clerical Officer | RI.F |
| Clerical Officer | RI.D |
| 12. Drivers | |
| Driver Grade I | RI.G |
| Driver Grade II | RI.D |
| Driver Grade III | RI.C |
| 13. Artisans | |
| Senior Artisan/Mechanic | RI.G |
| Artisan/Mechanic I | RI.F |
| Artisan/Mechanic II | RI.D |
| Artisan/Mechanic III | RI.C |
| 14. Auxiliary Cadre | |
| Senior Auxiliary | RI.C |
| Auxiliary Grade I | RI.B |
| Auxiliary Grade II | RI.A |

Leave Allowance

| | Employees in Job Groups | Rate in a Financial Year K.shs. |
|---|---|---|
| (i) | RI.N and RI.P | 900 |
| (ii) | RI.L and RI.M | 800 |
| (iii) | RI.H, RI.J and RI.K | 650 |
| (iv) | RI.F and RI.G | 500 |
| (v) | RI.C, RI.D and RI.E | 400 |
| (vi) | RI.A and RI.B | 300 |

Motor Vehicle Allowance (Regulation 10.7.1)

| Category of Vehicle | (A) First 8,000 kilometers in a financial year | (B) The next 1st 1,600 kilometers in the same financial year | (C) The next 1st 1,600 kilometers in the same financial year | (E) Remainder distance travelled in remaining part of the same financial year |
|---|---|---|---|---|
| Plus kilometer allowances | | | | |

Rate of Allowances

1. Accommodation/Special Accommodation Allowance (Regulations 9.2 and 9.4)

| | Employees in Job Groups | Rate per diem K.shs. |
|---|---|---|
| (i) | RI.N and RI.P | 300 |
| (ii) | RI.K, RI.L and RI.M | 250 |
| (iii) | RI.H and RI.J | 125 |
| (iv) | RI.E, RI.F and RI.G | 75 |
| (v) | RI.D and below | 50 |

2. Subsistence Allowance when Travelling on Duty Outside Kenya (Ref. Regulation 9.5)

| Category I | Director | Employees in Job Groups RI.L, RI.M and RI.N | All other Employees |
|---|---|---|---|
| | K.Shs. | K.Shs. | K.Shs. |
| Sweden, Denmark, West Germany, Japan, Ivory Coast, Nigeria, Australia, Saudi Arabia, Geneva, France and Kinshasa | 1,250 | 1,000 | 800 |
| **Category 2** | | | |
| USA, Canada, USSR, Rest of Europe, Central and South America, Israel, Hong Kong, Singapore, China, Kuala Lumpur, Sudan, and Lusaka | 1,050 | 950 | 750 |
| **Category 3** | | | |
| All other countries in Africa and Asia, including Uganda and Tanzania | 800 | 700 | 500 |

ANNEX VIII

## IDENTIFIED PROJECTS FOR STRENGTHENING KENYA'S NATIONAL AGRICULTURAL RESEARCH SYSTEM

| | PROJECT | LOCATION(S) | REQUIREMENTS | PROBABLE DONOR | IARC ASSISTANCE |
|---|---|---|---|---|---|
| 1. | National Maize Pastures Research Center | Kitale<br>Embu<br>Kakamega | Infrastructure, Staff. Project Operational Funds. | World Bank<br>FAO<br>USAID<br>UK - ODA<br>EEC<br>Australia<br>Netherlands<br>Germany<br>Canada (CIDA, IDRC)<br>Japan<br>Denmark (DANIDA)<br>Sweden (SIDA)<br>Norway (NORAD)<br>etc. | ACIAR<br>CIAT<br>CIMMYT<br>ICRISAT<br>ICIPE<br>ICRAF<br>IBPGR<br>ILCA<br>ILRAD<br>IIMI<br>IITA<br>ISNAR<br>AVRDC |
| 2. | National Irrigation and Drainage Research Center | Ahero<br>Garissa | Infrastructure, Staff, Training, Project Development & Operational Funds. | | |
| 3. | National Soil/Water Management Research Center (including Dryland Farming) | Katumani<br>Perkerra | Infrastructure, Staff, Equipment, Project Development and Operational Funds. | | |
| 4. | National Manpower Development and Training Project | MOALD<br>Nairobi | Training and Manpower Funds, Postgraduate Support for Univ. of Nairobi. | | |
| 5. | National Oilseeds Research Project | Njoro | Staff, Equipment. Operational Funds. | | |
| 6. | National Coordinated Research Projects (Crops) | NRCs and RRCs | Operational Funds. | | |
| 7. | National Coordinated Research Projects (Livestock) | NRCs and RRCs | Operational Funds. | | |
| 8. | National Research Laboratories (NAL, Muguga, Kabete (Vet.)) | Nairobi<br>Kabete | Staff, Equipment. Operational Funds. | | |
| 9. | National Farming Systems Research Project | RRCs | Staff Training, Operational Funds. | | |
| 10. | National Bean/Cowpea Research Project | Thika<br>Katumani<br>Mtwapa | Staff, Operational Funds. | | |

| PROJECT | LOCATION(S) | REQUIREMENTS | PROBABLE DONOR | IARC ASSISTANCE |
|---|---|---|---|---|
| 11. Regional Research Centers Support and Development | RRCs | Infrastructure, Staff, Operational and Development Funds. | | |
| 12. National Wheat Research Project | Njoro | Staff, Equipment. Operational Funds. | | |
| 13. National Research/Extension Linkages Project | RRCs Nairobi | Staff, Operational Funds. | | |
| 14. National Research Program Planning, Monitoring and Evaluation Project | Nairobi Headquarters | Staff, Operational Funds. | | |
| 15. National Horticultural Research Project | Thika | Staff, Operational Funds. | | |
| 16. National Animal Production Research Project | Naivasha Muguga | Staff, Operational Funds. Equipment | | |