Proceedings of the
Regional Workshop on Revitalizing
African Agricultural Research: An
Initiative for the Humid and
Sub-Humid Zones
of Western and Central Africa
October 6 – 9, 1992
International Conference Center
Abuja, Federal Republic of Nigeria

SPAAR Secretariat
The World Bank, Washington, D.C., U.S.A.
FOREWORD

There is a firm consensus in Africa and in the donor community that regional cooperation and integration is a key component for a more viable and sustainable economic development in Africa. The initiative launched in March 1991 by 17 Ministers of Agriculture from Central and West Africa to promote regional integration in agriculture research, is indicative of this consensus. The Twelfth SPAAR Plenary Session held in Rome, Italy, in December 1991, also recognized the importance of regional collaboration in agricultural research. It endorsed a proposal to join forces with the Conference of Ministers of Agriculture in West and Central Africa (CMAWCA) in an initiative to promote regional integration in technology development and transfer (TDT) through the development of a Framework for Action (FFA). This led to the joint SPAAR/CMAWCA Regional Workshop on "Revitalizing Agricultural Research in the Humid and Sub-Humid Zones of Western and Central Africa" which was held in Abuja, Nigeria, from October 6-9, 1992. The hosting of this workshop in Nigeria is in accordance with the country's lead responsibility within CMAWCA to address regional concerns of applied agricultural research.

The Workshop brought together a very wide and diverse audience, including, members of the scientific community, policy makers, representatives of the private sector, and donor agencies, and it endorsed and supported the initiative of the CMAWCA and resolved to support SPAAR in developing a FFA to revitalize agricultural research in the humid and sub-humid zones. One week of brainstorming led by the national agricultural research systems has helped in putting the design of the FFA on solid ground.

The high quality of the presentations and deliberations prompted the decision to publish the summaries of the papers presented at the Workshop.

Moctar Touré
Executive Secretary
SPAAR
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Page</th>
</tr>
</thead>
</table>

## FOREWORD

iii

## EXECUTIVE SUMMARY

1

- **Background on the Initiative: Purpose, Objectives and Desired Output of the Workshop**

1

- **Main Conclusions of the Technical Sessions**
  - The Economic Challenges of Agricultural Research in the Region
  - Working Group Sessions
  - Priorities and Strategies
  - Policy and Institutional Framework for NARSs
  - Linkages
  - The Role of the Private Sector
  - Regional Collaboration
  - Funding

2

- **Resolution on Revitalization of Research and Regional Collaboration in the Humid and Sub-Humid Zones of Central and Western Africa**

10

- **Proposals for Action**

12

- **Modalities and Time Frame**

12

## SUMMARIES OF PAPERS

18

- **The Relationship Between the Private Sector and Agricultural Research in Nigeria** / *F.O.C. Ezedinma and O.C. Onazi* 

19

- **National Agricultural Research Systems as the Backbone of Revitalizing Agricultural Research in West and Central Africa** / *T. Ajibola Taylor*

21

- **Science and the Farmer: Pillars for Building a National Agricultural Research System in Sierra Leone** / *Mohammed T. Dahniya*

23

- **Conference of Ministers of Agriculture for West and Central Africa Coordination of Regional Organization of Applied Agricultural Research--Nigeria’s Mandate** / *Yunusa Yusuf*

25

- **Proposed Centre for Research on Indigenous Livestock and Farming Systems of Sub-Humid West and Central Africa** / *Walter S. Alhassan*

27
Promoting Regional Collaboration through Networking: The OAU/SAFGRAD Experience / Joseph M. Menyonga and Taye Bezuneh ........................................ 29

Consolidated Funding Mechanisms / SPAAR ............................................. 31

Agricultural Research in Côte d'Ivoire / Daniel Etouna-Manguelle .................. 33

Africa and the Biotechnology Challenge / Auguste Kouassi .......................... 35

Collaboration among NARSs in a Regional Systems Approach: A Potential Role for IARCs / Peter J. Matlon ................................................. 37

Revitalizing Agricultural Research in Cameroon: Problems and Perspectives / Bernard Berka Njovens .................................................. 39

Revitalizing Agricultural Research in Nigeria: Issues and Options / Antonia O. Obeya ................................................................. 41

Research Priorities for Sustainable Cotton Production in the Humid and Sub-Humid Zones of Western and Central Africa / Alhaji Salmanu Abdullahi ..................... 43

Livestock Research in West Africa's Sub-Humid Zone: A Summary of Required Actions / Cees de Haan .......................................................... 45

The Role of Animal Agricultural Research / O.A. Ikuegbu ................................ 47

Dermatophilosis Research: The Need for Regional Collaboration in the Humid/Sub-Humid Zones of West and Central Africa / D.V. Uza ...................... 49

Fisheries and Aquaculture Research and Capabilities and Needs in Western and Central Africa / World Bank, UNDP, CEC, FAO ......................................... 51

Regional Cooperation in Agricultural Research in the Humid Zones of West and Central Africa: Status and Prospects / CORAF ................................. 53

Participatory Development of Agricultural Research: Strategy and Framework / World Bank Regional Mission, Côte d'Ivoire ........................................ 54


The Private Sector and Agricultural Research in the Humid and Sub-Humid Zones of West Africa: An Examination of Existing Practice and Potential / National Resources Institute (NRI) ........................................ 58

Climate and Sustainable Agriculture in Nigeria / J.J. Owonubi .......................... 62

Analytical Review of the Agricultural Research System of Ghana / Professor W. Asenso Okyere .......................................................... 64

Market Diversification and Agricultural Export Prospects in Sub-Saharan Africa / Ronald C. Duncan ......................................................... 66

The Economic Challenges for Agricultural Research in the Humid and Sub-Humid Zones of West and Central Africa / Ellen Hanak Freud ............................. 68

Valorization of Food Crops in Humid and Sub-Humid African Countries: State of Current Research and Future Prospects / CIRAD ......................... 70

Technical Notes: Banana and Plantain; Citrus; Cocoa; Coconut; Coffee; Cotton; Hevea; Oil Palm; and Pineapple / CIRAD .......................... 72
EXECUTIVE SUMMARY

Background on the Initiative: Purpose, Objectives and Desired Output of the Workshop

This workshop is a joint effort by the Conference of Ministers of Agriculture in West and Central Africa (CMAWCA) and the Special Programme on African Agricultural Research (SPAAR) to develop a regional framework for action for revitalizing agricultural research in the humid and sub-humid zones. The hosting of this workshop in Nigeria is in accordance with this country's lead responsibility within the Conference of Ministers to address regional concerns of applied agricultural research. SPAAR's mandate to help launch a framework for action in this region follows similar initiatives in the Sahelian countries and in the regional grouping of countries in Southern Africa under SADC.

These joint efforts reflect the recognition that major advances are needed in developing the agricultural sectors of countries in Africa, to provide food security and employment for a rapidly growing population, and to provide a dynamic source of foreign exchange earnings and supply of raw materials for domestic industries. To achieve these advances, technical improvements in the sector to raise productivity and to restore competitiveness in a number of areas will be essential: hence the primary role of agricultural research.

The need for a regional perspective on revitalizing agricultural research stems from the many areas of commonality within the two broad agro-ecological zones (humid and sub-humid) which characterize this region: countries in the region face many similar agro-ecological constraints, and share many similar problems in their livestock and crops, fisheries and forestry subsectors. It thus seems
evident that gains can be made in the areas of research through combining efforts, minimizing duplication, and drawing on the relative strengths of one another.

The objective of the workshop, which brought together members of the scientific community, policy makers, representatives of the private sector, and donors agencies, has been to identify the areas where regional collaboration is likely to be most fruitful and the modalities for achieving this collaboration, and to jointly address the most crucial issues affecting the productivity of the national research systems within the region in the areas of policy, institutional factors, financial and human resources.

The following sections provide a summary of the main conclusions of the workshop technical sessions, the recommendations for furthering the development of a regional framework for action, and the concrete proposals for carrying out the preparation and validation process for these recommendations.

Main Conclusions of the Technical Sessions

The Economic Challenges of Agricultural Research in the Region

Agriculture has multiple objectives of primary importance to this subregion:

- Meeting the food security needs of rapidly growing populations;
- Increasing the profitability of agricultural exports in a highly competitive world market;
- Generating employment and ensuring sustainable growth to preserve the resource base;
- Sustainability, i.e. increased production without environmental degradation.
Thus, there is a necessity to minimize the costs of production and post-harvest losses, and to maximize value added through quality improvements and processing in the subregion. There is an urgent necessity for research to generate a wider range of technology options that can be adopted depending on the diverse situation of the producer and the economic environment. Previous attempts at technology generation and transfer have not achieved the results necessary to meet the objectives of progressive agricultural growth and development. In addition, there is a wide gap between the improvements proposed by research and those realized in the field, especially among the majority of smallholders and agro-processors.

For research to meet these challenges, given its limited resources, there is a need to set priorities, both at the national and regional levels. It was suggested that this process could best begin by answering the following types of questions so as to identify and choose the areas of emphasis of the research programs.

- Are the commodities (crops, animal, fisheries, and forest products) economically important, and are demand prospects favorable?
- What are the major constraints and costs for production, post-harvest handling, and processing?
- How do productivity changes affect the poorest producers and consumers?
- What are the prospects for improving productivity through research?
- What are the conflicts with environmental sustainability?
Working Group Sessions

The four working groups made many recommendations, as discussed in their detailed reports. The following reflects some of the major points that emerged.

Priorities and Strategies

Working group I developed long lists of commodity and factor priorities, supported by detailed background papers and the discussions of the participants. This provides the foundation on which a regional/SPAAR task force and each NARS can develop national and regional priorities for the framework for action.

Policy and Institutional Framework for NARSs

Working group II addressed the policy and institutional issues of the NARSs in the region. Its regional recommendations are incorporated in a subsequent section. It was noted that the real basis for beneficial regional cooperation are strong and effective NARSs. With respect to specific issues in the NARSs, it concluded that:

(a) Each NARS should have a modest capacity for policy analysis;
(b) There is a need to match the size (human resource and infrastructure) of the NARSs with research priorities and the anticipated availability of the recurrent budget to both operate and sustain the system;
Working Group Sessions

The four working groups made many recommendations, as discussed in their detailed reports. The following reflects some of the major points that emerged.

Priorities and Strategies

Working group I developed long lists of commodity and factor priorities, supported by detailed background papers and the discussions of the participants. This provides the foundation on which a regional/SPAAR task force and each NARS can develop national and regional priorities for the framework for action.

Policy and Institutional Framework for NARSs

Working group II addressed the policy and institutional issues of the NARSs in the region. Its regional recommendations are incorporated in a subsequent section. It was noted that the real basis for beneficial regional cooperation are strong and effective NARSs. With respect to specific issues in the NARSs, it concluded that:

(a) Each NARS should have a modest capacity for policy analysis;
(b) There is a need to match the size (human resource and infrastructure) of the NARSs with research priorities and the anticipated availability of the recurrent budget to both operate and sustain the system;
(c) There should be a consultation mechanism involving researchers, policy makers, clients of research (farmers, the extension service, processors, input suppliers, etc.) in order to translate national objectives into research objectives;

(d) Research targets should be set with mechanisms for monitoring and evaluating research programs, researchers, and research output in order to establish accountability;

(e) Research institutions should have some management autonomy;

(f) Research institutions need to have the flexibility to attract and retain quality research staff; and

(g) Research scientists should participate in, and be rewarded for, the transfer of technology.

Linkages

Working group III addressed the linkages between national research institutes, universities, extension systems, farmer organizations, and NGOs, and made recommendations.

(a) Efforts should be made to use the capabilities of the universities for research and extension, with the universities being contracted to carry out parts of the research agenda. This linkage would also have benefits for the relevance of teaching and research, leading to higher calibre, more effective graduates. A tradeoff might have to be made between the number of students and the size of the university's research program.

(b) Some form of reorganization of the research and extension services should be considered to ensure the full involvement of farmers, extension agents and scientists in research and development. This needs to commence from the outset of research programming.
(c) The NGOs provide a considerable resource in the sub-region, which is often neither fully recognized nor fully utilized in research and extension. NGOs should be used according to their comparative advantage, particularly for working at the grass-roots level, on research and extension priorities.

The Role of the Private Sector

Working Group IV addressed the current and potential roles of the private sector in agricultural research and technology transfer in the subregion. The present substantial contribution of the private sector was noted, and the following recommendations were made to increase its participation and its collaboration in the implementation of the national and regional research agenda.

(a) It is important that governments create an enabling environment in which the private sector can make its contribution (intellectual property right protection, access to competition for research contracts, consideration of fiscal incentives, etc.).

(b) To facilitate their collaboration with the private sector, public research institutes need to involve the private sector in the determination of research priorities and put in place transparent procedures for contracting out research. Public institutions should also examine the scope for commercializing some of their research output.

(c) Multinationals should be encouraged by governments to participate in the training and financing of research.

(d) The local private sector should be encouraged to form associations so as to have the critical mass to participate in the formulation of research priorities and to compete for research contracts.
Donors and governments should work towards the creation of an enabling environment that will promote the involvement of the private sector. A particular way of promoting these interactions is by providing financial support for information exchange networks, seminars, etc., which bring the various actors together.

Regional Collaboration

The panel on regional collaboration highlighted the great diversity (agro-ecology, NARSs, commodities, etc.) within the subregion, with its attendant strengths and weaknesses. While many of the NARSs lack sufficient capacity to address all their major technical problems, there is a great capacity for technology spillover among countries within the region. Effective linkages have not been sufficiently developed between and amongst the NARSs and the International Agricultural Research Centres (IARCs), thus limiting the potential impact of regional collaboration. However, there are now positive changes taking place in the interrelationships between these centres and the NARSs. Because the IARCs focus exclusively on food crops and production systems, there is a special need for regional cooperation among the NARSs in the area of commercial crops. The existence of many research networks was noted, as also that their effectiveness to date has been limited, and that some harmonization is urgently required.

Among the many issues noted on which agreement is needed to establish effective regional collaboration, the following three were considered the most important:

(a) There are already a number of regional institutions in existence. How should this pluralism be best utilized to enhance regional output, to remove unnecessary duplication of roles, and increase efficiency?
(b) How should countries in the subregion measure the strengths and weaknesses of their NARSs (defined to include the private sector) with a view to sharing responsibilities for the implementation of regional research agendas?

(c) How to achieve political validation of regional cooperation, which will be backed up by allocation of sufficient, timely, and sustained finance, and the commitment on the part of lead institutes to share their results with other countries in the region?

Funding

The second panel discussed the financing of research, and specifically the proposed SPAAR Consolidated Funding Mechanism (CFM). The objective of the mechanism is to assure the coordination of financial support from all potential sources (government, donors, private sector including farmers, NGOs) for an agreed program of research. The mechanism is designed to ensure sufficiency of capital, personnel, and recurrent and linkage costs for a length of time sufficient to produce results. The mechanism must provide transparent and fully accountable records of funding sources and uses for the various research activities. Each research activity within the overall program must indicate the program of work, with the full costs (human and financial) and the expected outputs, and submit to periodic monitoring and evaluation of achievements. It was emphasized that a portion of the research funds for each country would be dedicated to the support of regional programs. There was a general agreement that the CFM could be a useful tool for countries within this sub-region.
In its final plenary session, the Workshop endorsed the conclusions and recommendations of
the various panels and working groups and this was written into a resolution, a proposal for action and
a timetable for implementation, as indicated subsequently. The summary of conclusions and the
resolution are supported by the reports of the working groups and the panels.
Resolution on Revitalization of Research and Regional Collaboration in the Humid and Sub-Humid Zones of Central and Western Africa

The Workshop noted and documented the weakness and degenerating situation as well as the potential for improvement with regard to agricultural research efforts and outputs in the subregion of West and Central Africa.

- Conscious of the need to revitalize agricultural research to meet the current and evolving challenges of agricultural production and economic growth in the subregion;

- Desirous to approach these needs through strengthening our national agricultural research systems and through regional and international cooperation and collaboration;

- Aware that projects and individual institutions approaches had led to a multiplicity of programs, activities, and organizations that aim at assisting research systems in strengthening their research capacities;

- The Workshop resolves to endorse and support the initiative of the Ministers of Agriculture and to support SPAAR in its attempt to develop a Framework for Action (FFA) as a basis of revitalizing agricultural research in the subregion. It recommends that the framework should consider the creation of an "umbrella mechanism" or "service" and the development of programs for strengthening and revitalizing research in (a) the humid zone and (b) the sub-humid zone of the region in collaboration with NARSs in these zones;

- It is also recommended that the ingredients of each of these programs should include the development of national and regional strategic plans; the setting of national and regional
research priorities; plan implementation strategies which reflect a rational division of labor among national, regional and international agricultural research institutions operating in the region based on an objective analysis of institutional comparative advantages; and the strengthening and improvement of research management. It is envisaged that these programs would be financed through donor-assisted projects and mechanisms with counterpart funds from member countries;

- It is also recommended that the framework should focus on:

(i) Coordination and rationalization of programs and activities in the sub-region;

(ii) Coordination and rationalization of networks;

(iii) Encouragement of the initiation of projects;

(v) The development of National Research Master-plans (NRMP) and Consolidated Funding Mechanisms (CFM) in each country;

- In these processes, SPAAR is urged to seek the support and collaboration of other international and regional organizations, funding agencies, donors, and other actors in this field;

- It is hoped to report on this resolution and recommendations, and the continuation of these initiatives to the Council of Ministers of Agriculture in the subregion and SPAAR donors as soon as possible.
Proposals for Action

Modalities and Time Frame

To initiate the implementation of the proposed resolution the following actions were taken.

Establishment of an Advisory Committee (AC)

TERMS OF REFERENCE

The overall mandate is to assist SPAAR and the Federal Ministry of Agriculture, Water Resources and Rural Development (FMAWRRD), Nigeria (acting on behalf of the Council of Ministries of Agriculture in Western and Central Africa) in the design, development and validation of a Framework for Action.

The specific expectations are:

- To assist in fine-tuning the operational objectives, process and methodology of the undertaking;
- To provide guidance to the SPAAR Secretariat and various individuals and groups entrusted with special tasks related to the FFA through formal meetings and written comments by individual members of the AC;
- To appraise progress made in the technical and political validation of the end products.
• A satisfactory holistic, systematic and participatory approach will be used throughout the process;
• A balanced technical, socio-economic and policy inputs and considerations will be taken into account;
• The end products are consensus-based, of high intellectual quality, technically feasible, and politically and financially realistic;
• The process is nationally and regionally driven, and that a proper mechanism would be established, and action taken to consult and involve competent national and regional decision-making bodies, the private sector, grass-roots organizations, donors, international research institutions;
• The process would be built on past and ongoing experiences.

COMPOSITION

Countries: Nigeria, Ghana, Côte d'Ivoire, Congo, Sierra Leone, Zaire, Guinea (Conakry).
Regional: (ECOWAS, UDEAC, SAFGRAD, IRAZ, CORAF, ENDA).
International Institutions: (IITA, WARDA, ISNAR, CIRAD, ILCA)
Appointment of Task Force for the Development of FFA(s)

COMPOSITION

Core Team

(i) Ajibola Taylor, ISNAR, Team Leader
(ii) Y. Yusuf (Nigeria)
(iii) B. Ouyogode (Côte d'Ivoire)
(iv) G. Boukambou (Congo)
(v) M. Dahniya (Sierra Leone)

Support Resource Pool

(i) SPAAR Secretariat and Membership
(ii) IARCs (IITA, ILCA, WARDA, ICRAF, ISNAR, IFPRI), and other regional and international institutions (CIRAD, NRI)
(iii) Independent Consultants
The Task Force will develop a Framework for Action in agricultural research for the humid and sub-humid zones of West and Central Africa. The terms of reference (TOR) for the Task Force are as follows:

- Review of relevant background information on natural resources, agroclimatic potential, land use, potential and productivity, demography, regional food situation, regional and international trade and transport, agricultural growth prospect and its sustainability, and the current roles of national, regional and international agricultural research institutions;
- Review of ongoing agricultural research programs/projects and assessment of their impact and linkage to extension;
- Analysis of problems and challenges facing agricultural technology generation and transfer;
- Preparation of a Framework for Action (FFA), on the basis of the working papers, the outcome of the Regional Workshop on the Revitalization of Agricultural Research for the Humid and Sub-Humid Zones of Western and Central Africa, held in Abuja, Nigeria on October 6-9, 1992 and other relevant sources. Special emphasis should be placed on:
  (a) narrowing down priorities with focus on regional collaborative opportunities;
  (b) analysis of institutional capacity of all actors involved in technology generation and transfer; and
  (c) assessment of ongoing regional collaboration programs and networks with a view to improving their effectiveness;
• The FFA should consider proposals on the roles of the public sector research and extension institutions, the universities, regional agricultural research organizations, the International Agricultural Research Centers (IARCs), the private sector, NGOs, farmers and farmer associations, and the linkage to extension and other stakeholders in research and development;

• Formulate proposals on the form and functions of a regional agricultural research coordinating facility;

• Formulate proposals for regional agricultural research cooperation on the basis of comparative advantage and consensus among nations;

• Identify some priority research programs that would lend themselves to regional cooperation and collaboration and suggest mechanisms and processes for systematic priority setting, leading to a national master-plan consistent with regional cooperation;

• Make proposals for human resource development and management for effective agricultural research, and with a view to forming a competent, motivated and stable national and regional scientific community; and

• Recommendations on streamlining ongoing programs/projects to reflect actions proposed in the FFA, and proposals for donor coordination at national and regional levels.
Time Frame

**Stage 1:** November 1992 - June 1993

- Review of agricultural research in the sub-region, with emphasis on the identification of limited areas of common interest for regional cooperation and the potential for revitalizing national agricultural research capacity
- Consideration of the nature and the type of "umbrella mechanism or facility" required
- Report on progress to the Council of Ministers of Agriculture

**Stage 2:** June 1993 - December 1993

- Report on progress to the Council of Ministers of Agriculture
- Completion of draft Framework for Action
- Design and validation of the Framework for Action for West and Central Africa with programs for sub-humid and humid zones

**Stage 3:** January 1994 - December 1997

- Development of a regional "umbrella" organization and pilot implementation of the FFA
THE RELATIONSHIP BETWEEN THE PRIVATE SECTOR AND AGRICULTURAL RESEARCH IN NIGERIA

F.O.C. Ezedinma and O.C. Onazi

Introduction

Agricultural research has been an integral part of the agricultural services provided by government since the establishment of the Nigerian Department of Agriculture in 1921. This service has remained almost exclusively in the public sector. The Nigerian private sector has been largely concerned with agricultural production and related enterprises in response to shifts in public agricultural policy. Unlike the Nigerian private sector, corporate agricultural enterprises which are invariably concerned with commodity crops and linked with multinational corporations fully recognize the importance of research and take positive steps to initiate research locally or depend on their parent organizations for that purpose. The basis of this divergence in the perception of the importance of agricultural research is heavily conditioned by government public policies and programs which has hitherto been skewed towards assisting smallholders to produce while relying on public research institutions to solve their operational problems. In other words, subsidizing public agricultural policy tacitly discourages private sector initiatives in agricultural research. This situation now impinges on the emerging Nigerian medium- and large-scale agricultural entrepreneurs who appear to recognize the value of agricultural research to their enterprises. Consequently, this sector has not demonstrated active commitment to agricultural research either by establishing its own research units or collaborating with the National Agricultural Research System.

The objective of this study was to ascertain the extent of the Nigerian private sector participation in agricultural research. Specifically, the study was to identify the divergence in perception of agricultural research and the extent of collaboration of the private sector in national agricultural research and to recommend ways of active involvement and collaboration in the research agenda. Private sector perception of and participation/collaboration in agricultural research was assessed from the results of a limited survey of some private agricultural enterprises and public financial institutions in parts of the forest and savanna agro-ecosystems.

Recommendations for Improving and Strengthening Private Sector Participation

Public agencies currently serving agriculture should be rationalized and restructured to minimize duplication and conflicts which impede dialogue with the private sector. Some of the services, especially fertilizer, agro-chemicals and tractor hire, should be privatized to enhance access and efficiency of delivery to the private sector.

The private sector should be actively encouraged to associate closely with NARS scientists and extension agencies to share experience and ready access to research results. This can be achieved through private sector sponsorship of research in NARS and participation at scientific conferences, seminars and workshops.

Private sector interests and efforts in agricultural research would be enhanced if publicly acknowledged and integrated into the national research agenda by NARSs through mutual exchange or the short-term attachment of scientists and contractual investigations in special problems identified by the private sector.
Easy access to liberal agricultural incentives such as subsidies, credit tax relief and pricing policy could encourage the private sector to participate more readily in national research efforts.

A more dynamic progressive public agricultural policy as an instrument for eliciting active Nigerian private sector participation in agricultural research should be pursued in consultation with the private sector and sustained through appropriate legislation.

Finally, this preliminary study highlights the need for a greater in-depth survey and analysis of the Nigerian private sector in order to clearly delineate its expected proper role and extent of involvement in agricultural research.
Introduction

The convening of this workshop could not be more timely in the history and evolution of agricultural research and development in this part of Africa. It is even more significant that the leaders in public policy, the private sector, the scientific community and the research community are taking the initiative, in collaboration with national, regional and international agencies, to bring together the nations of West and Central Africa to address the problem of revitalizing agricultural research in the subregion. A direct interpretation of this initiative is that there is high-level appreciation of the unfortunate and deteriorating state of agricultural research, and of the priority need to make concerted and consolidated efforts to revitalize it as a key component of and contributor to agricultural development in the 1990s and into the next century.

The challenges of this critical period when our nations must act, and act speedily, to address the questions of sustainable agricultural resource utilization and improved productivity dictate that agricultural research which was earlier recognized as a significant "engine of growth" should not be allowed to stall and further deteriorate. The decline in the productivity and impact of agricultural research must be arrested and the trend reversed by positive initiatives that would strengthen national capacities, and visions that transcend the boundaries of individual countries, emphasizing our common heritage and aspirations.

Conclusion

This presentation makes the case for, and places emphasis on, the critical importance of strong national agricultural research systems as the cornerstone of the strategy to revitalize agricultural research in the subregion. Strong national research systems do not mean large, expensive or complex systems. The suggestion is that every country needs a system that is able to organize, mobilize and execute research and utilize resulting information in a cost-effective way. As appropriate, the country should be able to generate, apply and adapt knowledge and technologies in a relevant and development-oriented context. It is only when sufficient national capacity is attained and sustained that regional collaboration can become meaningful, productive and mutually reinforcing.

Regional collaboration will not substitute for national research capacity but could reinforce and accelerate the pace of development. The NARS should therefore be seen as the backbone of the strategy to revitalize agricultural research without detracting from the essential linkages (regional and international) that would stimulate, facilitate and expand their capacities to contribute most effectively to the development process.
This initiative to revitalize agricultural research in West and Central Africa through discussions at this forum presents us with challenges and opportunities that we cannot afford to ignore. There is much talk, in international circles, of aid fatigue, but I believe that even with the changing status of cooperation and assistance, sound programs that aim at building sustainable capacity and self-reliance in agricultural research have a substantial chance of support internally and externally. With the commitments shown here, our initiative and determination can blend the so-called twilight of foreign aid with the dawn of self-reliance and partnership in building, sustaining and revitalizing agricultural research in the humid and sub-humid zones of West and Central Africa.
Introduction

At present, agricultural research in Sierra Leone is fragmented with no unifying policy and no systematic communication between research institutions. There is a considerable duplication of efforts and some unproductive rivalry which the country can ill-afford in its present state of economic crisis. A body to coordinate research and to link research with extension is especially critical for the future of Sierra Leonean agriculture.

In 1985, the government established the National Agricultural Research Coordinating Council (NARCC) with the responsibility of:

(a) Providing the government with research information which will assist it in formulating agricultural policy and considering agricultural, scientific and technological advances affecting the use and conservation of the nation's renewable natural resources;
(b) Managing and coordinating existing research institutions and advising the government on the establishment of new stations;
(c) Establishing a research-extension link;
(d) Diffusing technology; and
(e) Overseeing agricultural and related training.

NARCC was relatively inactive from its establishment until 1989 when it started receiving government funding. If agricultural research is to make any headway in the country, NARCC should be made to function outside the civil service bureaucracy with a high level of government support. The Council's present membership of highly qualified and influential professionals can execute its mandate effectively. The two institutions under its jurisdiction, the Rice Research Station and Institute of Agricultural Research have qualified and motivated staff to assure the realization of its objectives.

Conclusion

NARCC should have the responsibility of overseeing the recurrent personnel and operations costs of research institutions, and award funds that it solicits from government and international agencies to agricultural scientists in research stations, universities and other institutions. NARCC should be able to produce a national policy, priority and strategy paper for agricultural research and technology diffusion, annual plans for research and technology diffusion, implementation procedures and criteria for evaluating, authorizing, funding and monitoring research proposals and produce journals and bulletins on agricultural research and technology diffusion.

Agricultural researchers in Sierra Leone should devote a substantial part of time to adapting available information and genetic material produced locally, and in the IARCs, for the benefit of local farmers.
The present linkages between research and extension in the country are not strong. There is a need for teams of trained professionals working under the auspices of the research institutions and NARCC who will participate in every stage of the research-extension process. There should be two-way communication between the professionals and local farmers, and these communications should address the primary concerns of the farmer among which should be included crop production, food processing, storage and preparation.

The agricultural research system in the country should center around NARCC which should ensure that its priorities, rather than donor preferences, direct the course of the nation’s agricultural research. In the end, there should be an effective, unified agricultural research system to mobilize and direct adaptive systems-oriented agricultural research.
Introduction

A significant proportion (40 percent) of Africa’s total population, nearly 200 million people, live in the Western and Central African region. Agriculture is the major sectoral and economic activity and provides an average of 35 percent of GDP, 60 percent of total export earnings and employment for 80 percent of the population. The majority of farmers are restricted to small family holdings and are only able to make a precarious living in the generally unsatisfactory social and economic environment.

The Conference of Ministers of Agriculture for West and Central Africa (CMAWCA) was launched in Dakar, Senegal, in 1990 in order to lay the foundations for sustainable regional development in the agricultural sector. The other goals of the CMAWCA were to create an intra-regional agricultural market and to improve the competitiveness of African products in the international market. The countries that attended the launching included Benin, Burkina Faso, Cameroon, Côte d'Ivoire, The Gambia, Ghana, Guinea-Bissau, Mali, Niger, the Central African Republic, and Senegal. The meeting recognized the importance of extending an urgent invitation to all the other member states of the Economic Community of West African States (ECOWAS) and UDEAC.

Nigeria initially became involved when it attended the Conference session, held in Dakar, Senegal in March 1991. Eight areas for cooperation were identified during this session, including the Regional Organization of Applied Agricultural Research, which Nigeria was asked to coordinate. The priority accorded agricultural research was in recognition of its singular role in the development of agricultural and livestock products for domestic, regional and external markets. Currently, the development of these products is prejudiced by the increasing numbers of national and subregional institutes, much compartmentalization, scarce resource availability and lack of effective linkages between researchers and farmers/processors.

For these reasons, the Dakar Conference identified the following measures for immediate priority action:

(a) Consultation between socio-professionals and research institutes working in the fields of agronomy and animal husbandry;
(b) Regionalization and/or specialization of research centers; and
(c) Regional protection of the results of research.

Action Taken So Far by Nigeria

(i) Appointment of a four-person group which, after studying the documents from the Dakar meeting in 1991, advised the government to actively participate in the initiative
(ii) Participation at the second conference of Ministers in Paris, France, September-October, 1991
(iii) Identification of donors to support the activity, i.e. the World Bank
(iv) Appointment of a National Coordinator

(v) Establishment of a Pilot Committee

(vi) Participation at the SPAAR Working Committee meeting in Abidjan, February 1992; organized the initial steps towards the formulation of a Framework for Action (FFA) for the humid and sub-humid regions of Western and Central Africa

(vii) Hosting this Workshop, jointly with SPAAR, on behalf of the CMAWCA as part of its assignment to coordinate the Regional Organization of Applied Agricultural Research
PROPOSED CENTRE FOR RESEARCH ON INDIGENOUS LIVESTOCK AND FARMING SYSTEMS OF SUB-HUMID WEST AND CENTRAL AFRICA

Walter S. Alhassan

Introduction

The cattle and small ruminants of the sub-humid zone of West and Central Africa are small-sized, hardy, and prolific. With the declining plant biomass of the semi-arid zone, the larger-framed Zebu cattle are migrating into the sub-humid zone with the attendant risk of high disease challenge (notably trypanosomiasis) to them and indiscriminate crossbreeding with trypanotolerant breeds. In Ghana, as in many parts of sub-humid West and Central Africa, there is an increasing demand for bigger animals by local farmers resulting in an increasing population of crossbred Zebu - West African Shorthorn (WASH) cattle often called Sangas. There is a growing danger that the genetic purity of trypanotolerant cattle will not be maintained.

Traditional farming systems in Africa integrate crops with livestock. However, in the sub-humid zone, cropping is more commercialized than ruminant livestock production. A centre to coordinate crops and livestock production research and identify socio-economic or cultural constraints to livestock production is needed in this zone.

Proposed Centre’s Goal

To increase the productivity of trypanotolerant livestock, notably WASH cattle and amplify the interdependence of crops and livestock in the zone.

Proposed Centre’s Objectives

(i) Characterize all trypanotolerant livestock breeds in the zone.
(ii) Undertake, within breeds, genetic improvement of the trypanotolerant cattle, sheep and goat breeds in conjunction with local farmers.
(iii) Study the nutrition, management and health of trypanotolerant cattle for beef production and draught purposes.
(iv) Study appropriate manure handling systems for soil improvement.
(v) Study legume forages for soil improvement and livestock.
(vi) Undertake range improvement studies.
(vii) Study the breeding, nutrition, management and health of rural poultry.
(viii) Undertake socio-economic and anthropological studies regarding constraints to commercial livestock production by rural people in the zone.

Proposed Project Location

The proposed location is in the village of Demon in northern Ghana, bordering northern Togo. The site is a 50 square kilometer abandoned cattle ranch which has been transferred, on request, to the Animal Research Institute of Ghana by the Ghana Ministry of Agriculture. The transfer was effected in 1992. Some infrastructure, notably buildings, farm road, grazing camps, rice fields and fences are available but in a state of disrepair. Extensive rehabilitation and some new construction is required.
International Donor Assistance Requested

This assistance is needed to:

(i) Develop the newly acquired centre for research on indigenous livestock breeds and farming systems in sub-humid West and Central Africa;
(ii) Coordinate regionally livestock research in the identified areas;
(iii) Assist in the initial drawing up of a feasibility/development plan for the centre; and
(iv) Provide material and human support for the centre to take off.

Contact Person

Agents or persons interested in assisting should initially contact:

PROF. WALTER S. ALHASSAN
DIRECTOR, ANIMAL RESEARCH INSTITUTE
P.O. BOX 20, ACHIMOTA
GHANA
Phone: (233) 21 773551
Fax: (233) 21 773171 / 777655
PROMOTING REGIONAL COLLABORATION THROUGH NETWORKING:
THE OAU/SAFGRAD EXPERIENCE

Joseph M. Menyonga and Taye Bezuneh

Introduction

The food production situation in Sub-Saharan Africa (SSA) has continued to be a major concern both to member states of the Organization of African Unity (OAU) and to the international community, in search of a coherent strategy towards reversing the downward trend in the economic development of Africa. In response to the agricultural production crisis of the mid-1970s in semi-arid Africa, and in recognition of the urgent need for a concerted regional effort, African Heads of State and Government created the Semi-Arid Food Grain Research and Development (SAFGRAD) Project in 1977. SAFGRAD is one of the four regional operational programs of the Scientific, Technical and Research Commission of the Organization of African Unity (OAU/STRC). Through this Commission, under which networks and other SAFGRAD activities are implemented, the OAU provides the political umbrella and legal framework across geo-political boundaries, while the SAFGRAD Coordination Office (SCO), as an OAU-affiliated agency, plays the critical role of coordinating network activities and enhancing the development of scientific and research management leadership among NARSs.

The overall objective of SAFGRAD has been to improve the quality and quantity of the major food grains (sorghum, maize, millet, and cowpea), as well as the resource base for productive agriculture in the semi-arid regions of Sub-Saharan Africa.

SAFGRAD Strategy and the Concept of Networking

The main purpose of networking among the member countries of SAFGRAD has been to solve common problems of food production by judiciously pooling together scientific resources. Realizing the different levels of research capabilities among NARS member countries, SAFGRAD has adopted the collaborative mode (networking) as the central pivot of its activities, since the "critical research mass" necessary to sustain agricultural development was attainable only at the regional level. Networking as a regional strategy provides the mechanism for sharing resources, scientific talent, and technical knowhow in order to attain common goals such as meeting the food, shelter and energy demands of the growing population.

Conclusion

SAFGRAD has been able to revitalize the development of NARS-driven collaborative research networks, with the realization that no one country has all the natural and human resources to resolve all its agricultural research and food production problems. The OAU umbrella has enabled SAFGRAD to forge cooperative relationships among member countries and with the IARCs, achieving:

(i) Increased participation by NARS scientists and technical staff in SAFGRAD meetings, workshops and conferences;

(ii) Increased willingness by member states to host SAFGRAD events (meetings, workshops, etc), allow their scientists to offer technical services to other member states, and allocate their resources (land, laboratories, staff time, etc.) for network research activities;
(iii) Greater cooperation among member states in technical matters in spite of tense political situations; and

(iv) Further building and strengthening of scientific leadership in agricultural research in the context of SAFGRAD network activities.
CONSOLIDATED FUNDING MECHANISMS

Introduction

The objective of a Consolidated Funding Mechanism (CFM) is to ensure that an agricultural research system has sufficient and sustainable funding to implement its agricultural research strategy. A CFM does not necessarily have to be a pool of funds (a single bank account of co-mingled donor/government funds), but must be a pooling of effort. A CFM is used to ensure that the indirect overhead costs of research are sufficiently financed in addition to the research programs identified as priority in the national research strategy. It leaves governments the choice of requesting individual donors or other organizations to fund any set of activities. The introduction of CFMs can only be successful if governments and donors have confidence in the review/decision making and accounting processes.

CFM Objectives

The objective of a Consolidated Funding Mechanism is to provide for adequate, stable and sustainable funding of priority agricultural research activities that are responsive to national/regional development challenges and the constraints of the users of research results. To reach this objective, it is imperative that a CFM provides national authorities with an instrument to effectively coordinate donor funded research activities. A CFM is an instrument to pool efforts on an agreed and consolidated priority program by making sure that such efforts are adequately funded in a timely fashion. This does not exclude the actual pooling of funds, should this be desirable, but it is not absolutely essential.

Operational Considerations for CFM Management

Governments must establish (and institutionalize) a group or committee of all funding agencies and users of research results that will decide annually which research programs are to be funded and how. The group/committee should be chaired by a high-level civil servant ("Secrétaire Général"/"Directeur de Cabinet" or Under-Secretary) of the line ministry responsible for agricultural research policy. The group/committee should also include a high-level (Director) representative of each of the ministries of Finance and Plan (or economic affairs). The group/committee should have powers of decision with respect to the funding of agricultural research clearly spelled out in its statutes that are acceptable to all parties. The basis for the group/committee's functioning would be an endorsement of:

(a) The adequacy of the independent internal and external scientific/technical research program review process in place or to be proposed, and

(b) The suitability of the management instruments available to individual research institutions to be funded through the CFM.
Possible Institutional Implications

The introduction of a CFM should put into place the necessary conditions for an environment enabling creativity and innovation. It should be based on transparency and accountability. It would enable national research systems to achieve the stability of management and funding that is essential for productive research. Regional research could be funded through the inclusion of Special Research Programs for each of the regional programs in which a particular country wishes to participate. These special programs would be components of the national research strategy.
Introduction

Agricultural research in Côte d'Ivoire is one of the most successful in Sub-Saharan Africa and its success partly explains the development of the agricultural sector, particularly in the field of export crops (coffee, cocoa, oilseeds, pineapple, banana etc.). In the framework of the institutional settings that lasted until the early 1980s, the specialized research institutes were created and managed by France and were operated efficiently with a considerable administrative and financial autonomy, integrating research, development, production and marketing of products. Due to the fact that research partners were motivated by the high visibility of research results, research programs have remained close to their concerns, and thus have contributed to the development of a flexible and efficient research system responsive to the needs of the private sector.

The setting up of the Savanna Institute (Institut des Savanes, IDESSA) in 1982, demonstrated the first break with the past, and seemed to reflect a willingness by the Ivoirian authorities to be more active in this important sector of the country's economy. The move, however, had little impact in that, with the exception of cotton, the activities of the new structures were mostly geared at improving food self-sufficiency, and hardly generated any resources. The development of research centers for the forest zone, which are the spearhead of Ivoirian agriculture, has been more chaotic for reasons evidently linked to the magnitude of the stakes involved. After an abortive attempt in 1984 (at managing the French property transferred to the Government of Côte d'Ivoire), and after the Centre de Coopération Internationale en Recherche Agronomique pour le Développement (CIRAD) denounced the management convention signed seven years earlier, the Ivoirian authorities finally took on their responsibilities at the close of 1991.

Presently, agricultural research is at a crossroads, and the Côte d'Ivoire, with its back to the wall, must carry out without delay a restructuring process, the organization and timing of which the country does not seem to have mastered.

Issues

Considering the straitened circumstances arising from the dearth of financial resources, such restructuring raises some problems at several levels.

Establishment of New Structure

• Are the proposed joint ventures the best formula?

• How could structural flexibility, motivation of researchers, dialogue with users, and the participation of the private sector be maintained?
**Mobilization of Human Resources**

- Number and status of national researchers?
- Training and proficiency?
- Participation of universities?

**Research Financing**

- How to promote subregional cooperation? Could specialization of research centers be considered?
- Could the pooling of African financial resources be considered to ensure the operation of regional centers upgraded to the rank of "centers of excellence"?
AFRICA AND THE BIOTECHNOLOGY CHALLENGE

Auguste Kouassi

Introduction

The role of biotechnology in agriculture is most promising, in particular, because it enables a quicker process of selecting and nurturing various plant species. By using cultures from cells, tissues and plants, and genetic engineering, it is possible to cultivate and disseminate plants that are more protein-rich, insect-disease-, and drought-resistant, capable of producing their own manure from atmospheric nitrogen, and capable of withstanding high-salinity soils. Scientific techniques can also contribute to reducing production costs, and conserving disappearing plant species. Results already obtained, as well as the hopes vested in current research indicate that the application of biotechnology to agriculture may constitute one of the solutions to the crucial problem of food security in Sub-Saharan Africa.

In the humid and sub-humid zones of West and Central Africa, with the exception of the biotechnology center at Nkolbisson, Cameroon, the conditions for sustaining a scientific and technological environment necessary for the mastery and use of biotechnological tools have not been put in place by any country. In fact, there is an absence of appropriate infrastructure and specialized scientific equipment; the number of qualified scientific and technical personnel is inadequate; and the integration of basic and applied research is non-existent. Owing to the absence of a real national biotechnology program, research activities in a typical country are spread over several institutions and are very often linked to a researcher and laboratory, or are strongly influenced by bilateral cooperation ventures. Most of the countries have not designed appropriate policies to benefit from biotechnology in keeping with their needs and specific situations, and there is no single recommended policy regarding its use and development. It would thus be a tragic mistake for these countries to try and imitate the policies developed by the industrial and technologically advanced countries.

Conclusions

The advantage biotechnology has for the countries in these zones is that it can be developed from the biological resources of each country, and can be applied at varying levels of complexity and to varying types of materials. It is thus essential for African countries to assess the impact of the application of biotechnologies on their economies so as to take the necessary measures to protect their interests. It is also necessary for them to better appraise the possibilities offered by biotechnologies so as to make choices that will match their needs and aspirations. These choices must take into account the capital available, the critical views of researchers and technicians, the development of the industrial sector, and the significance and needs of the internal and regional market, etc. Appropriate biotechnologies that are less costly, tested and certified, and easy to transfer as well as to adapt to local conditions, should be developed and adopted.

Irrespective of the choices made, and given the magnitude of the resources required, subregional, regional and international cooperation should contribute toward fostering research, exchanges, the training of specialists and the dissemination of specialized information. The main objective of such cooperation is to strengthen national research capacities so as to enable each country to master a certain number of biotechnologies in order to provide solutions to development related problems. On the basis of clearly defined conditions, such cooperation would enable the countries involved to study their common problems, carry out concerted research, and apply the results in countries belonging to the same region or subregion. Such cooperation should be supported by international biotechnology centers in the continent. These centers which, like the International Institute for Scientific Research and Development...
in Africa (IIRSDA) at Adiopodoume, Côte d'Ivoire, have an adequate infrastructure and equipment, and could become the locus for technical cooperation between countries and the impact point of collaboration with industrial countries for the implementation of mutually beneficial programs. This is provided, of course, that the centers have substantial and regular funding as well as the necessary number of qualified researchers and technicians.
COLLABORATION AMONG NARSs IN A REGIONAL SYSTEMS APPROACH: 
A POTENTIAL ROLE FOR IARCs

Peter J. Matlon

Introduction

The IARCs represent a significant investment of resources in agricultural research by the international community, an investment which should be fully exploited for the development of collaborative regional research programs. To achieve this, however, requires imagination, a willingness on the part of NARSs and IARCs alike to re-examine old roles and mandates and, where they exist, to put aside old suspicions based on perceived conflicts of interest. Although IARCs have operated in Africa for more than twenty years, their relationships with NARSs remain ambivalent, and at times strained. One of the stated goals of these centers has been to strengthen national programs, but, with the exception of human resources development, it is generally recognized that IARCs have had only limited success contributing to sustainable improvements in national capacity. Clearly, the IARCs are only partially at fault, as many of the structural and institutional problems internal to NARSs would have frustrated even the best-planned and well-intentioned initiatives. Nevertheless, IARCs approaches in working with NARSs have been flawed and have in some instances contributed to the marginalization of African national programs.

The New Partnership

These problems have recently become more widely appreciated among the IARCs as well, and some IARCs have responded by proposing a radical restructuring of the NARS/IARC relationship based on jointly developed eco-regional partnerships. Recognizing the increasingly tight international funding situation, the goal of the new partnerships is to achieve the most cost-effective means of generating and transferring new technologies within entire regions. An important novelty of the partnership approach is the view that all research participants, whether they are within NARSs or IARCs, are part of an integrated and interdependent regional system. Also new is the perception that IARC research agendas need to be increasingly NARS-driven. The partnerships have two basic operational objectives:

(i) To achieve a more complementary and efficient sharing of research tasks between NARSs themselves and between NARSs and IARCs by allocating responsibilities on the basis of comparative advantage; and

(ii) To achieve a scientific critical mass on a regional scale.

These objectives carry far-reaching consequences for how research planning should be conducted.

A current example of an IARC playing a pro-active regional coordination role is that of the West Africa Rice Development Association (WARDA). The WARDA approach operates around a set of regional Task Forces. Task Forces are composed of all NARS rice scientists in the region who are working on closely related thematic problems in similar agro-ecologies. WARDA has been instrumental in establishing six active Task Forces to date. The Task Forces, however, are self-managing, with Steering Committees composed of and chaired by national scientists. WARDA has played a catalytic role by providing the initiative and logistical support for Task Force members to hold planning meetings, and subsequently obtained donor funding to support collaborative research projects endorsed by the Task Forces for execution by national programs. Although WARDA’s Task Force approach to partnerships with NARSs is relatively recent, its positive reception by national programs and its initial successes suggest that it may constitute a useful model for adaptation to other crops and regions.
Conclusion

Partnership is a process, not a project to be completed in a tightly defined time frame and all participants need to recognize this. The essential starting point is to develop a solid consensus around the goals and around a common vision of regional complementarity. This consensus must include the NARSs, IARCs, regional institutions and donors. Once this consensus is reached, members must be prepared to enter into a period of experimentation in which various institutional mechanisms are tested, modified and applied in a guided but iterative fashion. A medium- to long-term commitment of at least ten to fifteen years is essential.
REVITALIZING AGRICULTURAL RESEARCH IN CAMEROON:
PROBLEMS AND PERSPECTIVES

Bernard Berka Njovens

Introduction

In spite of some noteworthy achievements, agricultural research in Cameroon needs revamping. Though some important results have been obtained in the domain of cereals, palm oil, cotton, banana, and root crops, there is a need to ensure that ongoing research programs increasingly reflect development-oriented priorities. Currently, research programs vary considerably in their level of priority, scope and staffing. Some of the key problems facing agricultural research in Cameroon are resource constraints, a general squeeze on public expenditure for structural adjustment and competing demands for limited available resources. Revitalizing agricultural research will, to a great extent, depend on how well these issues are addressed in any reform process.

Conclusion

A thorough review of all research programs is needed to improve program structure, discontinue unpromising work, relate research findings to client needs, reinforce linkages, and identify gaps in research coverage. A first and necessary step in this direction would be the elaboration of a Master Plan, to reassess the planning, programming and evaluation of agricultural research on the basis of the country’s economic and strategic goals. This demand-driven Master Plan should be established in consultation with the farming and scientific communities, the private sector, universities, extension agents, non-governmental organizations (NGOs), and the National Agricultural Research Systems (NARSs) of neighboring countries. It should serve as a road map for future action, should have regional relevance, avoid duplication of efforts, and guarantee mutual technology spillover. Increased linkages and better coordination are needed between the ministries of research and production on the one hand, and between the different national and foreign research institutes, parastatal organizations, and donor projects on the other.

Given that virtually all farms in Cameroon are integrated multicrop and livestock enterprises, a multidisciplinary research systems approach is required. This implies an integrated and flexible research system, which initially defines problems from the farmers’ perspective and uses multidisciplinary teams to develop the most appropriate solutions. Applied and adaptive research should be given priority, since the research must directly address development-related problems. It must be relevant and likely to yield useful technologies that are adaptable to local constraints and conditions.

There is a need to train more specialized researchers in view of the wide variety of programs that the research institutes are involved with. The research institutes need a better technician/researcher ratio, and a better matching of staff to meet research priority needs.

Institution building is vital to the development of a professional research environment. The production of science-based technology requires mutual intellectual stimulation, exchange of knowledge, peer reviews, academic incentives, and recognition. These elements are built up slowly over time, and bring success only after a critical mass of scientists is in place. This long gestation period is a precondition for creating an effective national agricultural research capacity. Government should encourage this long-term, forward-looking approach to research.

39
To correct the variable flow of public funds to finance agricultural research, the research institutes have to be more self-financing, and this implies changing their mandates. The current situation strengthens the case for seeking non-traditional sources to finance agricultural research and the increased involvement of the private sector. The government should create the enabling environment conducive for private sector involvement in agricultural research, by enacting necessary macroeconomic policies.
REVITALIZING AGRICULTURAL RESEARCH IN NIGERIA: ISSUES AND OPTIONS

Antonia O. Obeya

Introduction

Nigeria has the largest agricultural research system in Africa. In the past this system has been responsible for several technological innovations. However, it has been plagued by several issues which have affected its ability to do effective research work. These issues include the following.

Policy Guidance

Two separate councils are responsible for overall agricultural policy and for agricultural research policy, respectively, with minimum reciprocal representation on each others' boards. The interaction is insufficient to develop a well-coordinated research policy on an ongoing basis.

Institutional

From 1970 to today (1992), the institutional structure for managing agricultural research has changed eight times. Discontinuities in research management have seriously affected sustainability, have disrupted agricultural planning, and have left considerable confusion in terms of coordination and reporting arrangements.

Priority Setting

The Federal Government's policy objectives relating to agriculture and agricultural research as stated in its policy documents on the subjects are vague, and vague policy objectives translate into vague priorities.

Funding

The research system has suffered from a shortage of funds in real terms since the early 1980s. Funding has declined from 89.6 million naira in 1977 to 16.1 million naira in 1991, a decline to 18 percent of the 1977 level. In addition, the release of funds has been erratic. The situation is exacerbated by the fact that minimal staff retrenchment or program closure has accompanied the decline in funds, with the result that most of the funding is utilized for recurrent costs such as salaries and overhead costs.

Information

Funding shortages have affected the availability of scientific information (publications, etc.) to the researchers, and has meant that researchers cannot participate in important regional and international workshops that are necessary as a means of information exchange, or hold national ones.

Human Resources

Serious imbalances exist between the number of researchers and administrative and service staff. While there is an overall shortage of skilled manpower in the agricultural sector, the basic problem seems to be the absence of incentives, work program, and recurrent financial support on a consistent and predictable basis for the staff that are present.
National, Regional and International Collaboration

The existence of several research networks with closely related areas of focus has implications with regard to the time management of individual scientists.

Conclusions

Technological progress and the increased use of modern inputs will have to be the main sources of future agricultural growth, if Nigeria is to accelerate its agricultural production growth rate. The management and financing of the Nigerian agricultural research system with a clear objective function is a critical issue facing Nigerian agriculture, and is an issue that has not received sufficient attention. Given the likelihood that funding for agricultural research will remain limited in light of the overall difficult economic situation in Nigeria, a research strategy reflecting a revised national agricultural development goal is necessary. There is an urgent need to improve the management and operational funding of the agricultural research system if scarce resources are to be used efficiently in priority areas. A master plan for agricultural research, reflecting the government’s broader development objectives, needs to be developed and must be dynamic enough to reflect changing national and farmer priorities. A mechanism for executing the national master plan must be put in place. The roles of the major actors, the government, the universities, the donors, the IARCs, the relevant regional organizations and the private sector must be clearly defined.
RESEARCH PRIORITIES FOR SUSTAINABLE COTTON PRODUCTION
IN THE HUMID AND SUB-HUMID ZONES OF WESTERN AND CENTRAL AFRICA

Alhaji Salmanu Abdullahi

Introduction

The countries of Sub-Saharan Africa are today faced with the challenges of increasing agricultural productivity using their existing land area. Effective research is important for sustainable increases in agricultural production. Under conditions of declining soil productivity and resource degradation, the challenges are immense. Discussions on revitalizing agricultural research in humid and sub-humid Western and Central Africa will be incomplete if cotton does not appear on the agenda. This is because cotton is one of the most important agricultural commodities in these zones with nearly 1,000,000 hectares being cultivated in Nigeria, Cameroon, Senegal, the Central African Republic, Sierra Leone, Ghana, Chad, Burkina Faso, Mali, Benin, Togo, Côte d’Ivoire, and The Gambia.

In recent years, cotton production in the anglophone countries of the zones has declined, while the francophone countries have been witnessing a significant boom. Inefficient marketing arrangements, poor prices, scarcity of credit and lack of inputs were particularly blamed for the decline in production in the English-speaking countries. To be specific to the Nigerian experience, the “oil-boom” in addition to marketing difficulties largely contributed to the decline in agricultural production. Output of cotton fell from over 500,000 bales (181.43 kilograms) in 1970 to about 40,000 bales in 1986. It was at this stage that the Nigerian government effected the deregulation of the country’s agricultural commodity markets by abolishing the commodity marketing board system. This left cotton marketing in the hands of the private sector where prices are determined largely by market forces. Private investors, such as the Nigerian Seed Cotton Company Limited, have since then undertaken the task of organizing and funding the purchase of seed cotton, and the processing and supply of its products (seed and lint) to manufacturers.

The Role of the Private Sector

One of the measures that can be taken to facilitate research activities in cotton production is through increased participation of Non-Governmental Organizations—in particular, by members of the organized private sector, including the cotton merchants, cotton ginners, textiles and chemical manufacturers in the area of manpower development, funding, and direct involvement in research activities. It will reduce overdependence on public funds which is increasingly becoming unable to sustain effective research projects, and lead to more cost-effective and result-oriented research activities.

Priority Areas

Research should be farmer-oriented and should fit into the farmers’ cultural practices. The major challenge facing our researchers, therefore, is the need to focus on cotton growers through a research system that maintains close links with, and allows the participation of the farmer. The emphasis should be on simple and affordable technology. The economic aspects of cotton production is another area that does not seem to be getting the desired attention from researchers. Commitment to production, marketing and processing of a commercial crop is purely dependent on its profitability. Therefore, issues such as prices, input supply, costs, efficiency of resource use, managerial ability of farmers, concentration, integration, and competitiveness of the market, supply response, etc. should also be assigned top priority. In addition, intensive research on the extraction of other materials from the crop beyond spinning and weaving and extraction of oil, cake and pellets is needed.
Conclusion

Cotton occupies an important position in the agricultural economy of this region and numerous research and development priorities must be addressed. To this end, I wish to call on the Government of Nigeria and those of other countries involved in this workshop to consider the establishment of a regional cotton research institute.
LIVESTOCK RESEARCH IN WEST AFRICA'S SUB-HUMID ZONE: A SUMMARY OF REQUIRED ACTIONS

Cees de Haan

Introduction

With Africa's arid zones already at the limit of their carrying capacity, its highlands already very densely populated and cultivated, and the humid forest areas unsuitable for livestock production, most of the growth in production to meet the demand for livestock products will have to come from the sub-humid zone. As population pressure increases, cropping intensity will increase in this zone, and a progressive shift from the present cropping systems with relatively low fallow periods to a much more intensive system will occur. To make these emerging intensive systems sustainable, the study argues that it is essential to integrate crop and livestock production. Thus, there is an urgent need to develop technologies which will allow the optimum integration of crops and livestock for this zone.

The main technical constraints to livestock production in the zone are the fragility of the prevailing ecosystems, the infertility of its soils, and the poor quality of pastures, forages and crop residues, especially as regards their protein content. Similarly, more intensive production with poultry and—in some areas—pigs will be severely constrained by a lack of protein feed resources. These soil and feed constraints are compounded by the strong disease challenge, especially from vector-borne diseases.

Research Needs and Strategies

There are major technology gaps, and research strategies will have to focus on the identification of:

(a) Appropriate farming systems;
(b) Appropriate feeding systems;
(c) New control and diagnostic techniques against vector-borne diseases;
(d) Strategies to accelerate the rate of increase of the disease resistance breeds, and the development of more efficient conventional breeding systems; and
(e) Appropriate policies for the management of the fragile ecosystems of the sub-humid zone, including the definition of better land tenure and management systems, and the incentives and marketing strategies for enhanced stratification of the industry among the arid and sub-humid areas of West Africa.

Institutional Needs

It is crucial that all research bodies (NARSSs, regional and international organizations and the private sector) work together, and perform well. The Winrock study recommends:

(a) Emphasis by the NARSSs on strategic, applied and adaptive research, with a close professional interaction between crop and livestock scientists;
(b) A much stronger regional cooperation, such that countries with common agro-ecological and other features cooperate in the funding and conducting of research.

---

(c) The establishment of a livestock and crop research center for the sub-humid zone of West Africa, and the study offers ILCA's Cooperative Program in Kaduna, Nigeria, CIRDES in Bobo-Dioulasso and the addition of an animal dimension to the IITA in Ibadan as possibilities to accommodate such a program; and

(d) The study recommends where the IARCs are concerned, the ILRAD's mandate be expanded to include research on the basis of genetic resistance to all vector-borne diseases, and that ILCA should focus increasingly on strategic research on feeds and fodder, the utilization of crop residues and the physiological bases of nutrition. In cooperation with IITA, ILCA should conduct research in the sub-humid zone on the development of feeds for poultry, pigs and aquatic animals.

For research in animal agriculture, the study recommends a coordinating mechanism for donor funding, enabling donors to join forces and assure better long-term funding stability. Under this system of improved funding coordination, a small secretariat would be established to assist regional organizations with program formulation in a cohesive fashion. To meet individual donor needs, the systems would permit donors to select the countries and research activities, similar to the processes employed by the individual centers of the CGIAR.
THE ROLE OF ANIMAL AGRICULTURAL RESEARCH

O.A. Ikwuegbu

Introduction

Livestock occupies a key position in the economy of the African farmer. The sub-humid zone (defined as lying between the 900 and 1500 millimeter isohyets and having 180-270 plant growing days) covers 22 percent of Sub-Saharan Africa and 50 percent of Nigeria's land area. Malnutrition is recognized to be a major constraint to animal productivity in Africa. The natural range is low in quality and in quantity. The grasses are characterized by rapid growth after rains and early maturity, and the digestibility, nitrogen and mineral content of these grasses decline rapidly after the early wet season.

Most of Nigeria's livestock are kept by smallholders under traditional management. These farmers are primarily dependent on natural range for forage in the sub-humid zone, though considerable importance is attached to crop residue grazing when it is available. Supplementary feeds such as cotton seed and ground nut cake are purchased whenever they are available at reasonable prices and there is considerable interest in ILCA's forage interventions. The responses obtained from such supplementation leave a lot of room for further improvement in productivity and the development of a more efficient feeding system, which is desirable in that it would optimize the use of the different feed resources.

ILCA's Approach

The objective of ILCA's research is to develop "farmer ready" techniques to pass on to national livestock development and extension agencies. The research is conducted within a livestock systems research approach with diagnostics, design, testing and application/extension phases. ILCA works directly with agro-pastoralists and smallholders using their livestock and land. ILCA's major partners are the Nigerian agricultural research institutes and the State ministries of agriculture, as well as the State Agricultural Development Projects (ADPs). The overall objective is to develop low input nutrition packages for adoption. ILCA recognizes that there must be strong crop/livestock linkages for sustainability of the packages.

ILCA's major work in the zone has been the introduction of the legume *Stylosanthes* spp. In-depth studies have revealed that *Stylosanthes* fixes nitrogen in the soil, and makes the soil easier to work thus reducing the drudgery of farm work. It also results in increased yields of crops when the land is subsequently cropped three to four years after establishment.

ILCA's scientists have shown that the incorporation of *Stylosanthes* into pasture increases the productivity of livestock, and have developed the concept of a fodder bank (4 hectares of *stylosanthes* pasture) established near a homestead for the dry season feeding of cattle.

ILCA recognizes the role of small ruminants in the economy of the smallholder. The incorporation of herbaceous legumes into the cropping system is driven by the farmers' perceived benefits. ILCA's scientists have now developed the mini-fodder bank package (areas 0.10-0.14 hectares) for small ruminant grazing in the wet season when small ruminants have to be restrained so as to stop crop damage.
ILCA's future focus in the medium term is in peri-urban dairying as well as in the introduction of traction into the zone. ILCA also plans to screen indigenous legumes in order to broaden the feed resource base of livestock. Working in partnership with NARSs, ILCA hopes that great strides can be made in increasing livestock products and their consumption by the rural dwellers, thus contributing to the improvement of the diet of the people.
DERMATOPHILOSIS RESEARCH: THE NEED FOR REGIONAL COLLABORATION
IN THE HUMID/SUB-HUMID ZONES OF WEST AND CENTRAL AFRICA

D.V. Uza

Introduction

Dermatophilosis is a bacterial disease caused by *Dermatophilosis congolensis*. The disease is a worldwide phenomenon, affecting cattle, sheep, goats, horses and human beings. Dermatophilosis is endemic in humid/sub-humid West and Central Africa where it constitutes a significant obstacle to the improvement of milk production and cross-breeding. In Nigeria, virtually all the exotic breeds of animals imported in order to improve milk production through cross-breeding programs have been wiped out primarily due to the disease. The failure of these dairy programs has made Nigeria the biggest importer of milk and milk products in Sub-Saharan Africa.

Importance of Dermatophilosis

In the Northern States of Nigeria, over 1.2 million cattle are affected annually by clinical dermatophilosis, i.e. 10 percent of a total cattle population of 12.7 million cattle. It is prevalent in the wet season. In the early 1970s it was estimated that between 3 percent and 13 percent of hides were affected by dermatophilosis in the cities and towns of Kano, Katsina, Zaria and New Bussa. This situation has forced the 24 mechanized tanneries and 24 organized footwear companies to operate at half the installed capacity or even less (Lamorde 1991). Approximately 350,000 hides amounting to millions of naira are ruined annually. The disease causes a 20 percent decrease in milk production over a short period of time.

The results of a recent survey indicate that 11.5 percent of draught cattle in the rural areas of Nigeria are affected by the disease. This represents a serious constraint to the application of traction as a useful agricultural tool. Attempts at using imported cattle for cross-breeding to improve milk and meat production has failed due to dermatophilosis.

The Way Forward

Dermatophilosis is classified by the FAO as one of the four most serious bacterial diseases worldwide. The disease appears to have defied control and treatment and certainly needs more attention. More information is required for estimating its importance, assessing the efficacy of known prevention methods, assessing therapeutic drugs and investigating genetic control methods. There is ample justification for a regional collaborative research effort on the disease within humid/sub-humid West and Central Africa. Since dermatophilosis is primarily a disease of the developing countries, responsibility for finding a remedy to the disease should basically rest with them.

A proposed meeting of anglophone and francophone countries in humid/sub-humid West and Central Africa is scheduled to be held in Nigeria in April 1993. It is intended that the meeting will reach a consensus on the location and constitution of a regional centre for dermatophilosis research, as well as establish linkages with other centers involved in similar research in and outside the subregion.

---

It is further intended that SPAAR and donor countries will be approached after this meeting to provide resources for the activities of the centre and its network.
FISHERIES AND AQUACULTURE RESEARCH AND CAPABILITIES
AND NEEDS IN WESTERN AND CENTRAL AFRICA

World Bank, UNDP, CEC, FAO

Introduction

A Study of International Fishery Research (SIFR) has been undertaken under the auspices of a group of development and aid agencies. Its purpose was to provide a diagnosis of development constraints and management requirements, to determine the priority research needs in developing countries, to assess their capacity to undertake the corresponding investigations, and the ways in which the donor community could contribute effectively to strengthening the research capacities of developing countries.

The mission attempted to assess whether decision-makers, researchers and private operators have the same understanding of these requirements. Differences of appreciation between administrators and researchers, and among private operators were noted.

Conclusions

At the government level, the critical importance of good research for dynamic economic growth of the sector is appreciated. This understanding materialized in the development of national research institutions and in the support of regional cooperation between research institutions involved in the monitoring of shared resources.

Research institutes have a sound understanding of the goals and components of fisheries management, at both the national and subregional levels. Research plays a determining role in the formulation of government policies, and is deeply involved in the preparation of various inputs for their implementation.

At the industry level, the need for research for fisheries management was not recognized until overfishing eroded the profitability of fishing activities, to the point of threatening their existence. One of the reasons cited for this lack of confidence was the perception of a strong affiliation between the sectoral research institutes and the fishery administration. However, there is a willingness in the industry to support public research and to develop private research when possible.

Multilateral organizations play a determining role through their cooperation with national research institutions, in raising government awareness on the opportunities for fishery development, on the technical approaches to fishery development and management, and in the formulation of national sector policies.

The strengthening of national research capacities and the effective use of research findings for the economic growth of the sector depend on three conditions.

(i) Greater use of existing research capacities and research institutes since these are able, given adequate means, to expand their programs into new areas; shortcomings in national institutions are stronger constraints than current weaknesses of research programs;

---

(ii) International aid should match the needs that are specific to individual countries, and to the priorities that are set by governments. A critical mass of national researchers has to be created; the knowledge they have accumulated needs to be permanently upgraded and expanded; the environment of research has to be improved step by step. This requires coherence and continuity that only national institutions can provide; and,

(iii) Regional cooperation in research needs to be strengthened.
REGIONAL COOPERATION IN AGRICULTURAL RESEARCH IN THE HUMID
ZONES OF WEST AND CENTRAL AFRICA: STATUS AND PROSPECTS

Introduction

In Sub-Saharan Africa (SSA), agriculture is carried out by 70 percent of the population, the sector is responsible for more than 30 percent of the GDP and comprises over 40 percent of exports. It remains the bedrock of the economy in most countries. Yet, the region has been hit for several years by a multidimensional crisis which has spared no sector: high birth rates; declining per capita food production; increasing environmental degradation; extensive production practices; and, policies not suitable to local needs. In the light of this situation, and given the general context of structural adjustment, it is not possible to expect that each individual country would be able to increase resources devoted to research. However, considering the scope and similarity of the problem and constraints, African officials responsible for agronomic research are becoming increasingly conscious of the fact that it is absolutely indispensable for them to envisage a joint search for solutions by pooling their resources. For this reason, the case for regional cooperation is clear.

CORAF: An Original Response to the Crisis

The goal of CORAF is to create a true African scientific community that will strengthen each national institution through helping NARSs to work together. The novelty of this progressive approach lies in the fact that researchers identify common problems, define research priorities as well as establish the planning of activities to be implemented by associative networks and regional research teams. More concretely, CORAF is intended to promote the following: cooperation between member institutions through information exchange; definition of common objectives and the implementation of regional research projects; setting up and guidance of associative networks and regional research teams; and, consultation with the IARCs, the other regional or international organizations as well as with aid agencies.

After five years of activity, CORAF is now able to demonstrate its knowhow in terms of: identifying constraints; defining scientific priorities; organizing research teams at the regional level; managing joint resources; and organizing assessment teams. CORAF is also able to demonstrate its experience in the setting-up and monitoring of networks and base centers. Lastly, CORAF is ready to participate in all initiatives to improve the scientific and technological information flow within NARSs.

Conclusions

Efforts are being made by states as well as by subregional, regional and international organizations to promote economic integration. Such integration would be possible and would make sense only if all sectors of the economy were taken into account, the scientific research sector in general and agronomic research in particular. The measures being undertaken should enable the implementation of dynamic research for the economic development of the region and is adapted to the evolution of the national, regional and international contexts. In addition, such research should be capable of: conserving natural resources and ensuring their renewal through an efficient management of rural systems; providing food security through a better knowledge of the conditions of the market and a proper follow-up of consumption patterns; increasing producers’ income through greater competition in national, regional and international markets and reassessing the role of researchers by restoring confidence to the scientific actors through substantive and long-lasting measures.
PARTICIPATORY DEVELOPMENT OF AGRICULTURAL RESEARCH:
STRATEGY AND FRAMEWORK

World Bank Regional Mission, Côte d'Ivoire

The Problem

Considerable effort has been invested to develop more productive agricultural technologies for West and Central Africa farmers, research institutions, and numerous scattered "enclave projects." Research efforts were directed mainly toward varietal-improvements, the use of chemical fertilizers and other inputs in pure-stand crops, some elementary techniques of soil preservation, and the use of farm manure and residues. These efforts, although done in a (single) crop-oriented approach within a non-comprehensive fragmented framework, yielded some good and interesting on-station results. Yet, there exists a clear feeling among the majority of the resource-poor farmers (as well as many extension agents and research workers), that this "transferred" technology, developed with very little (if any) farmers' participation, is hardly appropriate. In addition, there is a feeling that all research is able to offer is "routine technical themes" with no innovations that can really help smallholders cope with the worsening farming conditions.

The Process of Participatory Technology Development (PTD)

The fundamental reason for farmers' involvement in PTD is that they can improve the efficiency of the formal research process, either in terms of improving the probability of a return, or reducing the quantity and cost of the research inputs required. In other words, farmers, because of their intimate knowledge of the complexity of their environment, can contribute constructively:

(i) During the descriptive/diagnostic stage, by articulating their needs or constraints which can help in formulating the appropriate research agendas of institutions;

(ii) During the design stage, by helping to evaluate possible solutions to the constraints or needs they articulate;

(iii) During the testing stage, by participating in the testing and ex-post evaluation of the potential solutions that were identified in the design stage.

Necessity for a Participatory Approach

A participatory approach to R & D is necessary in order to develop site-appropriate farming techniques which are both productive and sustainable, to make more effective use of research funds in the service of agriculture, and to increase smallholder capacity for self-sustaining development. At the necessarily limited number of sites where outside personnel and funds are available to conduct problem-oriented research, it has been found that farmer participation in designing on-farm trials requires fewer resources and less time than diagnostic survey research.

PTD cannot replace conventional research in laboratories, on-station and in scientists' on-farm trials. However, it involves flexible forms of applied and adaptive research which complement the more rigorous trials conducted according to formal scientific conventions.
Innovative R & D plays, therefore, an essential role in finding diverse ways of developing improved agricultural techniques in cooperation with farmers. Common to all participatory approaches are: a basic attitude of openness to farmers' concerns, ideas and knowledge; concerned efforts to develop low-external-input technologies which can be applied by resource-poor farmers; and, communication between farmers, scientists and extension specialists on an equal footing.
RESEARCH-EXTENSION-FARMER LINKAGE SYSTEM IN NIGERIA: CONTRIBUTIONS OF THE WORLD BANK

Turto Turtiainen, Ray Unamna and Joseph Yayock

Introduction

Countries with a large agricultural sector can accelerate their development through a pathway that ensures generation, development, adoption and evaluation of appropriate agricultural technologies for farmers. Adoption of improved technologies leads to increased agricultural productivity and higher income to the farmers. It may consequently lower the prices paid by consumers for agricultural products and lead to greater economic efficiency and growth in the national economy. This approach of developing and introducing new technologies to farmers has, therefore, become an important part of the economic development strategies of many countries. The major problem facing the aforementioned developmental pathway is finding an appropriate institutional framework for the research-extension-farmer linkage that would allow reaching a large number of farmers. A strategy for accomplishing this is evolving in Nigeria.

The World Bank is the largest single source of external funding for the development of agriculture in developing countries. Projects assisted by the Bank have a development orientation mostly directed toward institutional development and transfer of technologies between and within countries. In Nigeria, the Bank has helped in supporting the development of suitable technologies and their dissemination for use by farmers. In this effort, the Bank strongly supports the implementation of the Training and Visit (T & V) system of agricultural extension blended with Farming Systems Research methodology.

Problems Facing the Research-Extension-Farmer Linkage System

The research-extension-farmer linkage system has been virtually institutionalized in Nigeria. The problems are not insurmountable. Only a few, which require attitudinal change to remove the constraints, exist and they include:

(a) High frequency of labor mobility;
(b) Limited availability of literature;
(c) Lack of an adequate incentive structure for extension and adaptive research staff;
(d) Limited involvement of input agencies; and,
(e) Limited understanding of the World Bank’s role.

There appears to be an inadequate understanding by many Nigerian nationals, particularly the academicians, of the role played by the Bank as a partner in development in the country, and within some circles the Bank is regarded as an exploitative agency rather than as a partner in progress.
Conclusion

With the help of external funding and government support, the long-term prospects to improve Nigerian agricultural development through the research-extension-farmer linkage are good. However, lack of continuity in the programs and ignoring the existence of the problems enumerated in the short run could cause the Federal Government of Nigeria to abandon the strategy before the positive effects have become more pronounced than they are presently. Agricultural development, with so many participants and phases is a long-term affair and those involved in it must have patience. Fortunately, in Nigeria, the results have started to show. The last five years have witnessed overall growth of some 20 to 25 percent in agricultural production. We are convinced that a part of this growth must be credited to agricultural extension and its linkage with research and farmers.
THE PRIVATE SECTOR AND AGRICULTURAL RESEARCH
IN THE HUMID AND SUB-HUMID ZONES OF WEST AFRICA:
AN EXAMINATION OF EXISTING PRACTICE AND POTENTIAL

National Resources Institute (NRI)

Introduction

This paper examines the potential for increased funding of public sector agricultural research in West Africa by multinational corporations (MNCs) and northern non-governmental organizations (NGOs). In identifying areas of multinational interest in the agricultural sectors of West Africa, certain foci are immediately apparent: agricultural chemicals; agro-processing; plantation management; and seed supply and biotechnology. However, certain trends are also evident. Multinational activities tend to be stagnating or declining in the region currently, and this is because of:

(a) Present low world market prices for plantation and export crops, and
(b) The poor state of the region’s economies, caused by declining commodity prices and low oil prices (three of the countries concerned are oil economies).

MNC activities are therefore being streamlined, and increasingly undertaken through local subsidiaries. Additionally, for virtually all of the agricultural MNCs operating in the region, except those dealing in cocoa, West Africa represents a small market or supply source. Therefore, product development (and research) is largely geared to, and carried out in, other regions.

NGOs working in the humid and sub-humid zones emphasize traditional food crop varieties and the development of indigenous technical knowledge to improve output, while at the same time conserving or improving the natural resource base. At least five forms of NGO involvement with NARSs can be identified, all involving a transfer of resources from northern NGOs to researchers in the south:

(a) NGOs commission NARSs to carry out research;
(b) NARSs and NGOs carry out joint research, with the NGO usually paying for consumables, transport and casual labor;
(c) NGOs monitor and test NARSs technologies;
(d) NGOs train NARSs and extension staff; and
(e) NGOs organize farmers’ groups to draw on research services.

Recommendations: Concrete Steps to Encourage Collaboration

Actions by the host government

There are a number of mechanisms which are more specific to research needs that governments can use to encourage collaborative activity. These can be broadly categorized into three types of activity:

(a) Protection of intellectual property rights;
(b) Fiscal incentives; and
(c) Facilitating initiatives.
**Actions by the NARS**

There are two main ways in which NARSs can encourage collaboration with MNCs:

(a) By improving research quality; and  
(b) By establishing standard and simple procedures.

**Actions by MNCs and NGOs**

The private sector can encourage collaboration by taking action in the following areas:

(a) Providing industrial/NGO placements for research students and staff;  
(b) Providing improved documentation of their work to raise awareness of their activities; and  
(c) Joint-funding higher salaries for key staff within the NARSs, instead of attracting away their most competent research staff.

**Actions by the IARCs**

IARCs can further collaborate between NARSs and the private sector by:

(a) Helping to define and co-ordinate a rational process of regional integration with respect to research functions, agendas and processes;  
(b) Continuing to provide support to the NARSs to strengthen their performance; and  
(c) Acting as facilitators to regional networks and research information exchange.

**Actions by the donor community**

The donor community can encourage collaboration by:

(a) Funding northern institute links with NARSs where this can be used as a bridge to the international private sector;  
(b) Funding the training of research staff, to help NARSs achieve the necessary improvements in the quality in required disciplines and procedures;  
(c) Funding research projects that stress not only research topics but an "approach" more likely to be of interest to the private sector;  
(d) Funding workshops that help both sectors see where there are areas of mutual interest; and  
(e) Focusing on specific interests (e.g. environmental concerns) and MNCs’ sensitivities, to pressurize MNCs into supporting research in relevant areas.
AGRICULTURE AND PUBLIC SECTOR COLLABORATION
IN AGRICULTURAL TECHNOLOGY DEVELOPMENT AND USE
IN SUB-SAHARAN AFRICA: A SYNTHESIS OF FIELD STUDIES

William Lesser

Background

While many countries prospered during the 1980s, numerous Sub-Saharan African (SSA) nations have lagged in economic development, a condition made worse by the world-wide recession of the early 1990s. Many of the SSA nations operate with strongly nationally controlled economies which until recently allowed little or no role for the private sector, especially in agriculture. No one suggests that the economic difficulties of SSA are solely attributable to, or correctable by, a private sector role. The absence of a private sector, however, has made these economies less vibrant and increasingly detached from many national economies, ranging from the United States (U.S.) to Latin America to Southeast Asia, which are making progress in privatizing their economies.

It is within this general environment that the United States Agency for International Development (USAID) Africa Bureau's Division of Food, Agricultural and Resource Analysis (FARA) is developing a Strategic Framework for Agricultural Research in Sub-Saharan Africa (AID Africa Bureau 1992). This report is a component of that Strategic Framework, which is intended to build upon past experience in SSA and to further extend knowledge on how and where to foster technological change in agriculture in the region. Special emphasis is given to providing U.S. firms with greater market opportunities in that product area. The vehicle for providing this information is five technology case studies carried out in a like number of SSA countries during 1992. These countries are Zimbabwe, Kenya, Ghana, Mali and Cameroon. The principal subsector/technology/country pairs selected for the study were as follows: Cotton - Mechanical tillage: Mali; Maize - Chemical pesticides: Cameroon; Seeds - Biological: Zimbabwe; Poultry - Managerial: Kenya; and, Vegetables - Postharvest handling: Ghana.

Major Findings

The case studies support the underlying position of the Strategic Framework that technology development and adoption are commodity specific and dependent on the overall market for the commodity. Government policy has major effects on all aspects of technology development and stewardship. This is most easily seen in the negative ways in which policy through parastatal control or low prices prevent or limit private sector involvement. However governments can also specifically encourage private efforts and interaction. The public and private sectors are complementary in research and stewardship, not competitors. The view of the private sector as a competitor is often a major inhibitor to further collaboration. Stewardship of agricultural production is principally a public sector activity. The case studies contain few examples of private stewardship, especially at the production level and for credit. Yet these remain crucial to subsector growth. It is a major challenge to determine how to deliver these services when many government budgets are depleted. The situation for technological inputs is different - they are typically supported by the private sector manufacturer. Government services are improperly priced, and one component of public/private collaboration is and will remain the purchase of public services by the private sector. Presently, those services are mispriced, sometimes too high but often too low. Rectifying the matter will facilitate collaboration.
Major additional technology markets exist for the studied commodities. While the opportunities vary across the commodities, additional marketing opportunities exist in all cases. U.S. firms often have a relatively small market share which could be expanded. For the newer technologies/commodities (poultry products and export vegetables) the major inhibition to expansion is the absence of an overall coordinating role.

Intellectual property rights not presently available in SSA nations would be useful in stimulating local private investment and enhancing productive markets. The current patent protection scope in SSA is comparable to that of most developing countries, and the existence of patent unions simplifies the application process. For agriculture, the major exclusion is the patentability of plant and animal varieties, but that will not be a binding issue until agro-biotechnology products are employed commercially. Trade secret legislation, often an important complement to patents and R&D, is undocumented and should be explored further.
CLIMATE AND SUSTAINABLE AGRICULTURE IN NIGERIA

J.J. Owonubi

Introduction

The decline of the agricultural sector’s contribution to the Gross Domestic Product (GDP) in Nigeria has been largely explained by the huge oil sector development. But what cannot be explained away is that the actual level of agricultural production has not kept pace with the increase in population. Crop productivity has remained relatively unchanged, and these low yield levels, despite the increasing use of inputs such as fertilizers and intensified extension, is substantially due to the effect of an unstable climate. This partly explains why such words as drought, famine and desertification have become household concepts in Nigeria and indeed throughout Africa.

Climate is a natural resource which, properly exploited, determines what may be grown at any location, when and at what level of yield potential. The efficiency of exploitation of any resource is closely linked to the extent to which the resource can be defined. Sustainability in this discussion will imply agricultural practice that meets the increasing need for food and industrial raw materials of rapidly growing populations without degrading the environment. This is a summary, therefore, of the state of knowledge regarding the climate for sustained agricultural production in the Nigerian savanna with the objective of identifying gaps in our research effort which must be addressed for more rapid development.

Climatic Trends

Rainfall

The overall tendency in the last thirty years has been for lower rainfall and later start of the rains, particularly in Nigeria’s Guinea to Sahel savannas.

Evapotranspiration (ET)

The situation reflects a shrinking length of the rainy season and an increasing rate of ET.

Solar Radiation

It is important to note that while the mean sunshine hours per decade has decreased from January to April and October through December, the reverse has taken place from July to September. The increasing trend of sunshine during the period of peak rainfall suggests a decrease in cloudiness at this time and may have accounted for the observed reduction in annual rainfall.

The Harmattan

This refers to the occasional overpass of dust-laden Northeast trade winds arising from the Sahara and moving towards the Atlantic coast of West Africa. But the harmattan has today become a household name during the dry season across West Africa as it has become a major economic factor affecting aviation, communication and probably, agriculture. Preliminary investigations have indicated that the settling dust may reduce the yield of dry-season tomatoes. The same may be true of perennial trees and vegetation.
Implications for Agriculture

The instability of the African climate and indeed the world climate as discussed here means that our agricultural system cannot be static. While we must continue to gather and analyze detailed climatic data, the results must be harmonized with the development of appropriate seeds, set planting dates, phenology and possible crop combinations. The intensity of rainfall, and temperature must be weighted with soil types to formulate optimum levels of fertilizer use, as well as soil and water conservation measures for sustainable agriculture. Closely related to these issues is the need to focus our climate monitoring and agricultural climatological data acquisition towards the accommodation of agricultural hazards and production of yield estimates.
ANALYTICAL REVIEW OF THE AGRICULTURAL RESEARCH SYSTEM OF GHANA

Professor W. Asenso Okyere

Introduction

Ghana has made tremendous progress through pragmatic micro-economic, institutional and sector policies to reverse the economic decline that it experienced in the 1970s and early 1980s. However, despite the sector reforms the agricultural sector still remains virtually traditional with farm sizes usually less than five acres. The major problems facing research include:

(a) The relocation of the Council for Scientific and Industrial Research (CSIR), which has six agricultural research institutes, under the Ministry of Agriculture which is charged with the problems of the sector instead of under the Ministry of Industries, Science and Technology;
(b) Lack of a national research agenda resulting in research being conducted in an uncoordinated fashion with a large proportion of the effort being directed toward cereals which contributes less than 10 percent to the agricultural GDP, while neglecting the roots and tubers and plantains which contribute about 55 percent;
(c) Weak research-extension linkages;
(d) Staff issues such as attrition of experienced qualified staff to better paying jobs outside the country and of a large pool of secretarial support staff;
(e) Inadequate financial support from the government, combined with minimal involvement, particularly in the area of funding, by the private sector even though it is a major beneficiary of agricultural research results; and
(f) Virtually non-existent research linkages and collaboration with other African researchers and research institutes.

Conclusions

Although steps are being taken to draw up national agricultural research priorities under the World Bank-supported National Agricultural Research Project, the institutes (apart from the universities) involved in agricultural research should be placed under the Ministry of Agriculture to create a linkage between relevant research and effective policy making. There must be a shift of emphasis from grains research to roots and tubers and plantains which are the main source of dietary starch for the majority of Ghanaians. With the availability of a fair amount of production technology for the cereals, further research on cereals should concentrate on post-harvest management techniques to reduce losses and increase the demand for the products. Animal health and production and fisheries research must also be expanded so that Ghana can increase its production in these sub-sectors and reduce its dependence on imports. To ensure an effective research-extension-farmer linkage, there should be a greater use of the Training and Visit (T & V) technique being implemented by the Ministry of Agriculture. Since the farmer is a multi-product producer, farming systems research should feature prominently in the research agenda. In addition, to sustain any growth prospects in agriculture, emphasis should be placed on research on environmental issues.

If salaries of the professional staff in the research establishment cannot be increased in the short-term, they should be motivated to do their best by providing them with equipment and materials to work with and reputable avenues to publish their results locally.
Apart from specific studies, research output is usually a public good and as such needs massive support from the government. In order to increase its allocation to the research establishment, the government should set up a Research Fund into which deductions from various taxes collected can be paid into and appropriated for research purposes. The private sector should be called upon to be more involved in determining the research agenda for the country and also contribute towards research funding. There should be private sector representatives on the management boards of research institutes, and an endowment fund should be set up in each research institute and the private sector approached to make tax-deductible contributions. Research institutes can also improve their funding situations if they undertake consultancies for the government or the private sector.

Regional research collaboration should be intensified, especially in the West African subregion. This can be organized under the auspices of the Economic Community of West African States (ECOWAS). There will definitely be advantages in such a collaboration in terms of cost savings and the availability of an enhanced research capacity in the region.
MARKET DIVERSIFICATION AND AGRICULTURAL EXPORT
PROSPECTS IN SUB-SAHARAN AFRICA

Ronald C. Duncan

Introduction

Discussions of the agricultural exports of Sub-Saharan Africa (SSA) primarily involve coffee, cocoa, and cotton; and secondarily, sugar, tea, and tobacco. Only in cocoa, coffee, and tea do SSA countries, in aggregate, have a large share of the world market, with cocoa having the largest share of over 60 percent of world exports. Where they have a small share of the world market, SSA can expand its share without affecting the world prices or without much reaction from other producers. This is not true for cocoa, coffee, and tea. However, in either case, the prospects for SSA exporters are largely a matter of their own performance and how this is affected by their countries’ policies.

Agricultural Policy Options

SSA countries have to make sure they do what they do best, and in agriculture, this is most commonly producing cocoa, coffee, cotton, or tea. Only in this way will they have good prospects in increasingly competitive world markets. To retain, let alone increase, their shares, SSA countries have to adopt sensible macro-economic and sectoral policies. Kenyan tea production is a good example to follow: a sensible exchange rate policy, very low export tax, and good research and extension have been a recipe which has seen Kenya’s share of world tea exports grow from 5.7 percent in 1969-71 to 17 percent in 1990, and, we project, to 23 percent by 2005.

Market Diversification

Export diversification means the establishment of pricing, distribution, and marketing channels for the new goods or services. Establishing new export markets has proven to be a considerable hurdle for countries. Establishment of prices and price margins, spreading of information about prices, both domestic and overseas, and setting of product standard—whether these were done by government fiat or within a free market—have been in place for many years for traditional export commodities. For new commodities, these market functions have to develop, preferably with only the necessary help from government. For private investment activity to flourish, it needs to be able to hedge its risks. In terms of price risks, this means access to financial markets to hedge currency, interest rates, and commodity price risks; that is, access to futures and options, markets overseas as well as to over-the-counter financial instruments such as currency, interest rates, and commodity swaps.

Conclusion

The prospects for increased prices in real terms for SSA’s traditional export crops are poor. This is not to say that SSA’s share of world markets in these commodities cannot grow. Improved productivity, under the umbrella of improved macro and sectoral policies, is the key to increasing shares and profitability in these sectors. But it has to be recognized that there has been a change in relative prices away from the traditional crops, which means that new export activities will have to be developed. There appears to have been a bias in government policy and expenditures in favor of the traditional crops which has hurt the development of new ones. This should change and is likely to change with the change in relative prices, but will be slow to change because of the vested interests in the production, marketing and distribution of those crops.
There are many things which governments can do to help development of new export activities, but there are also many things which they are already doing which inhibit such development. Identifying those things which they should stop doing and those things they should do is critical and governments should next create a priority list of those activities which they should undertake. My suggestion is to concentrate on research into appropriate varieties for export markets, extension of advice on new technology, and investing in physical infrastructure for the efficient transport and storage of the commodities. However, the mistake should not be made of biasing policies and expenditures in favor of the non-traditional commodities, the attempt being rather to try to reach a neutral position.
THE ECONOMIC CHALLENGES FOR AGRICULTURAL RESEARCH IN THE HUMID AND SUB-HUMID ZONES OF WEST AND CENTRAL AFRICA

Ellen Hanak Freud

Introduction

Agriculture in this region must meet a multifaceted challenge: to feed rapidly growing populations, generate foreign exchange, and foster growth in per capita income through the creation of direct and indirect employment opportunities. Yet to date, the performance record has been uneven. Although food production per farmer appears to have risen over time, this has not kept pace with the growth of the non-agricultural population, and food imports have increased. In the industrial/export crops, many countries have seen their shares in world markets diminish. Technical progress has mainly been witnessed through the introduction of new crops into many areas, under extensive methods of cultivation. With few exceptions (notably in some of the tightly-run special schemes), small farmers have not adopted science-based techniques to increase yields.

Conclusions

Efforts of the research system alone will be insufficient to ensure agricultural growth and technical progress which will be essential to the sustainable development of the sector over the years to come. To prosper, agriculture requires hospitable policies which have often been lacking: above all, pricing policies which reward producers, and a climate which encourages both investment in the sector and its supporting infrastructure, and the development of institutions able to efficiently manage the various economic activities associated with commodity production (input distribution, marketing, processing, etc.).

The research system will need to play a major role in agriculture's development, and to do so, the system will need to find ways to improve the setting of research priorities, to ensure that it allocates resources towards meeting the economy's greatest needs. Summarized here are some of the important issues which will need to be explored and debated as the research system takes action to meet this challenge.

The Role of Demographic Pressure in the Farming Systems

A primary factor accounting for the failure of most small farmers to adopt more intensive land use practices over the past three decades has been the relative abundance of land in this region. As this land abundance disappears along with its associated fertility, research will need to be able to respond with solutions to the two complementary demands of raising yields and maintaining soil fertility.

The Management of Forest Lands

The land pressure on farmers will be accelerated if governments act to protect the existing land reserves under natural cover. Research is directly concerned with respect not only to its solutions for sustainable agriculture, but also to its solutions for sustainable management of the woodlands.

The Challenges of the Markets for Agricultural Outputs
For both local and export markets, agricultural production needs to stay competitive. *Understanding the structure of domestic costs in relation to the market challenges is an essential tool for setting research priorities.*

**Reorienting Research Programming to Meet the Economy's Demands**

For historical reasons, the clients of the research system in this region—the farmers and processors of agricultural output—have had little opportunity to be involved in setting research priorities. *A key to meeting the economic challenges of the future lies in their involvement in this process.*
VALORIZATION OF FOOD CROPS IN HUMID AND SUB-HUMID AFRICAN COUNTRIES: STATE OF CURRENT RESEARCH AND FUTURE PROSPECTS

CIRAD

Introduction

Africa’s humid and sub-humid regions are characterized by some common traits: the potential for food production is substantial, and most of the countries can provide agricultural surpluses to feed their cities. The food market is active and a considerable portion of the agricultural production is already part of the trade. These common traits should not mask the great diversity in nutritional systems. Three separate zones can be distinguished in the region in terms of nutrition: cereals-based nutrition zones; rice or maize; root- and tuber-based zones (cassava, yam); and mixed zones. In addition, food preparations vary considerably for any given product, (attieke, garri, chikwangne). Such diversity constitutes a richness that can be valorized taking into account the general nutritional trends. This general evolutionary trend is encouraging the consumers, especially in the urban zones, to seek nutritional diversification. Such willingness to diversify products and meals is also reflected in the opening of restaurants and street selling of products.

The risk of a growing and irreversible food dependence linked to urban growth should be analyzed carefully. The factors favoring the importation of food cannot be generalized. Some products are consumed as part of a need for the diversification of food consumption, and their significance thus becomes structurally based. Others, on the other hand, compete directly with local or regional food production. In general, the types of products available locally and suitable for urban consumption seem insufficiently diversified enough to anticipate the trend, or insufficiently competitive to resist the impact of import competition.

Current Research

The analysis of the state of knowledge and techniques for the valorization of local food products demonstrates the general lack of sufficient research efforts undertaken in this field. More effort has been concentrated on agricultural production than on its utilization. Population trends (high population growth and quick urban expansion) have rendered indispensable a real re-orientation of research to strengthen the viability of the entire market: consumption, distribution, processing and marketing. Up until the present (1992), food agro-industrial research had tried to innovate using two distinct market leads already in use: the first, using imported industrial products (compounded flours, “maize rice” for example); the second, using traditional foodstuffs (garri, attieke or industrial foufou, for example). In both cases, the chances of promoting new products are relatively small, and the results have been disappointing. In order to diversify nutritional choices, research could be geared towards producing new products for mass consumption. Such products could thus serve as direct substitutes for imported products or for traditional standardized industrial products.

The informal sector, most dominant in the valorization of local foodstuffs, has up till now hardly benefited from the results of research. Research in fact served the industrial sector. The considerable know-how that presently prevails in the informal sector, its significance especially in light of the segmentation of markets, and its importance as a source of jobs and income distribution, are all factors that support the need for a better linkage between research and the sector.
Future Prospects

The necessary development of agro-industrial research should be based on a better knowledge of the processing techniques and systems used in the region, as well as of the socio-economic aspects: nutritional preferences, management of the traditional and industrial processing enterprises, functioning of the marketing channels, etc. In the development of new products as well as in the design of new processing equipment, the exchange of know-how and scientific cooperation between Africa and other continents could be beneficial. Latin America and Asia could provide equipment and methods for the small scale processing of most of the African foodstuffs. These exchanges should however not be limited to information dissemination, but should involve concrete partnerships between the economic actors and researchers.
Banana and Plantain

Introduction

The countries along the west coast of Africa, particularly Guinea, Côte d'Ivoire and Cameroon, produce and export large quantities of dessert bananas. Production costs are markedly higher than in Latin America, essentially for technical reasons. Cooking bananas (plantains) are entirely consumed in the producer countries; for certain populations as a supplementary foodcrop, for others as a staple foodcrop. They are produced in most countries.

Opportunities for Scientific Breakthroughs

(a) In vitro culture (in conjunction with fallowing or crop rotation) could help to reduce phytosanitary constraints and associated high production costs for export dessert bananas; and
(b) Development of plantain varieties with acceptability for different consumers, resistance to black leaf spot and other fungal diseases, insects and pests (including bunchy top virus).

Citrus Fruits

Introduction

Techniques now used to grow citrus fruits in tropical countries have been largely derived from technologies transferred from the important sub-tropical production areas. Much adaptive research is therefore required to develop technologies appropriate for new family-type orchards in tropical zones.

Needs and Opportunities

The evident demand for a new tropical citrus fruit cultivation system demands appropriate research, since:

- Parasite pressure is often much higher in tropical regions, resulting in serious problems in managing the relatively limited gene pool used so far;
- High demand for trees, so causing clones to be propagated that have not undergone sufficient testing (agronomy and phytosanitary) with the resultant high risk of reduced orchard life span;
- Citrus fruits have a different growth cycle in the tropics and so research is needed in plant husbandry and orchard management (rootstocks, plant density, picking time, fertilization etc.)
- Market demand is for improved quality and new products, most of which only tropical countries will be able to provide.

Citrus research is long-term and costly and should best be undertaken through the pooling of efforts within regional and international networks.
Cocoa

Introduction

Sixty percent of world cocoa production comes from Africa. The main technical factors limiting cocoa production are parasitic. Most of the research is carried out in Côte d'Ivoire, Cameroon and Sao Tomé (in cooperation with CIRAD-IRCC) and Ghana (Cocoa Board).

Needs and Opportunities

Currently there are world surpluses, and so emphasis should now be placed on end product quality, rather than yield increases, *per se*. Also, it is important to increase the productivity of areas already planted, particularly by reducing operating costs or by inter-cropping with other crops. Genetic control against the main parasites, e.g. *Phytophthora*, is needed. Also, the development of sustainable smallholder cropping systems must be encouraged.

Coconut

Introduction

Coconut is a crop of minor economic importance in Africa. Significant research has been undertaken in only a few countries with that in Côte d'Ivoire achieving international renown for its breeding work.

Future Research Priorities

(a) Establishment of an African coconut germplasm network and working group on breeding;
(b) Creation of multi-site varietal trials;
(c) Breeding for drought tolerance;
(d) Breeding for resistance to MLO diseases and establishment of a research network;
(e) Research on stable coconut-based farming systems adapted to Africa;
(f) Small-scale/medium-scale oil production from fresh nuts, with integrated production of shell charcoal, fiber and a peat substitute;
(g) Establishment of research and development and extension officer training;
(h) Development of an *in vitro* vegetative propagation techniques for coconut will mean shorter selection cycles and therefore the production of planting material more suited to different environments;
(i) Optimization of farming systems; and
(j) Development of small-scale integrated processing units.

Coffee

Research Achievements to Date

*Canephora* (robusta) coffee breeding in francophone Africa has concentrated on productivity, with significant results. IRCC has established the world's largest *C. canephora* collection in the Côte d'Ivoire. No major progress has been made in anglophone countries. Little work has been done anywhere on quality improvement. A *C. arabica* variety (Ruiru 11), resistant to both coffee rust and CBD has been developed in Kenya. IRCC has made significant progress with agronomic research on *C. canephora*, including chemical weeding with herbicides.
Future Research Priorities

In the short-term, productivity increases to reduce grower costs are required, through identification of cover crops to improve soil fertility; provide mulch; reduce soil erosion; diminish the need for mineral fertilization; and act as windbreaks (*Flemingia congesta* is already being successfully used). Development of a pruning system specifically for smallholders and improved quality are also required. In the longer term, development of viable agro-forestry type integrated agricultural systems, as practiced in South Asia, combining coffee with other crops and other activities (such as livestock rearing) may be possible.

Cotton

Introduction

Cotton research in francophone Africa (led by IRCT) is currently of a very high level and is internationally recognized. The varieties created have the highest ginning output in the world and good technological qualities. Triple interspecific hybrids created at Bouaké have been widely cultivated in West Africa and used as parents elsewhere. Glandless varieties are now grown on a large scale in Côte d'Ivoire. Leaf analysis technique developed by IRCT in Zambia and other countries offers a valuable approach to mineral nutrition. Cotton research in the anglophone countries is led by Zimbabwe, where cotton pests have been controlled since the 1960s utilizing pest scouting.

Future Research Priorities

Faced with the declining economic situation, the main challenge is to maintain crop sustainability through respecting technical and phytosanitary advice; maintaining the fertility of cotton-based farming systems more cheaply (organic-mineral balance problem); making better use of inputs through multiple criteria decision-making charts; and improving fiber quality, for which the standard is now determined by automatic measuring systems (HVI).

Hevea

Introduction

Rubber has been grown for many years in some African countries (Liberia, Zaire, Nigeria, Cameroon and the Côte d'Ivoire). In 1992, African rubber production constituted only 6 percent of world natural rubber production, its small market share being a handicap in commercial terms. Recent research progress, largely the work of IRCA, can be summarized as:

(a) Creating clones adapted to soil and climatic conditions in Western and Central Africa that are currently being grown by farmers (average world yield 600 kilograms/hectare, average African yield 650 kilograms/hectare, average Côte d'Ivoire yield 1800 kilogram/hectare);

(b) Development of control measures (biological, genetic, mechanical and chemical) against the main hevea diseases occurring in Africa;

(c) Technical guidelines (including intercropping advice) are available for growers from land preparation to harvesting;

(d) Significant yield increases obtained in Côte d'Ivoire and Cameroon have resulted from the development of effective tapping systems;

(e) Recent progress with latex physiology research enables tapping systems to be adapted to planting material characteristics and production potential to be assessed;
Rubber viscosity in estate factories can now be stabilized with special treatments. The rubber research led by IRCA has achieved international renown.

Future Research Priorities. **Breeding:** widening of the range of high-performance clones on offer to growers. **Phytopathology:** development of biological control methods and disease-resistant or tolerant clones. **Husbandry:** reduction of field costs and adaptation of techniques for smallholders and control of tapping panel dryness. **Technology:** rubber quality and consistency to compete with synthetic rubber.

Development of a formal regional hevea research network could have beneficial effects for African rubber research.

**Oilpalm**

**Introduction**

Over the past few decades, international oil palm research, both in Africa and elsewhere has been dynamic, due partially to the worldwide influence of IRHO. While scientific achievements have been similar from one continent to another, development has varied greatly for bioclimatic, political and economic reasons. Africa imports oils and fats, whereas Southeast Asia is a major exporter. Oil yields vary greatly, 5.5 metric tons/hectare in Southeast Asia versus 3.5-3.8 metric tons/hectare in Africa. **Research Achievements:** **Genetic:** a reciprocal recurrent breeding scheme has been adapted to oil palm and has enabled the genetic variability base to be broadened and married with *in vitro* vegetative propagation provides potential for significant production gains. **Mineral Nutrition and Fertilization:** establishment of multi-site fertilization trials enables specific fertilizer recommendations to be made. **Fertility Conservation:** study on changes in soils under oil palm ensures good, sustainable stability, prevention of compaction, destructuring, reductions in water-holding capacity etc. **Phytopathology:** tolerant material now available versus vascular wilt and chemical pest control minimized through detailed study of the main pests and their natural parasites.

**Opportunities for Scientific Breakthroughs**

Oilpalm productivity and profitability is difficult to improve in Africa because:

(a) Climatic conditions are often marginal;
(b) Cost of inputs and investments is prohibitive;
(c) Presence of strong competition from Asian countries; and
(d) Often, smallholder production systems are poorly organized.

AFOPDA and Burotrop were established with potential benefits for the sharing of research tasks and results amongst all participating countries and organizations. Research which could have the most rapid effect on development in the smallholder sector is:

(a) A study of farming systems involving oil palms and their management with the objective of improving yields and work output;
(b) Development and installation of small scale basic, efficient palm oil extraction units that would be cheap in terms of both investment and maintenance.

**Pineapple**
Introduction

Although only 15 percent of world pineapple production comes from Africa, fresh exports from the western humid and sub-humid zones have been significant, especially from Côte d'Ivoire. Canned pineapple and pineapple juice exports have also been important earners of foreign currency.

Opportunities for Scientific Breakthroughs

Correct implementation of all the production and packaging techniques currently available with continued improvements to enable market share to be retrieved from Central America. Second, the establishment of a true domestic market based on the production of well-flavored, less fragile and colored varieties (not Smooth Cayenne) tolerant to the main pests and diseases.