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**FROM THE GROUND UP: AN INTERIM REPORT ON  
NATIONAL AGRICULTURAL RESEARCH SYSTEMS  
IN FIVE AFRICAN COUNTRIES**

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**EXECUTIVE SUMMARY**

**PURPOSE AND BACKGROUND**

1. National priorities and perceptions form an essential element in any program for strengthening agricultural research and development in Africa, as elsewhere. The purpose of this report is to present, as accurately as possible, the views of policy-makers, researchers, educators and development practitioners in Senegal, Mali, Ghana, Cameroon and Kenya, so that their perceptions might be integrated with donor discussions and initiatives. The authors hope that greater attention is paid to the views of the national actors rather than the brief commentaries that follow.
2. Agricultural research in all five countries began in colonial days; introduced by the French in Senegal, Mali and Cameroon and by the British in Ghana and Kenya. In the early days, research was concentrated on cash crops, and was meant to benefit the economic interests of the colonial establishment, but was later expanded to food crops, livestock, fisheries and forestry.
3. Up to the 1970s support for African agricultural research was strictly bilateral, involving national systems on the one side, and the governments of the former colonial powers on the other, with some private sector participation on both sides. Subsequently, the World Bank and USAID entered the African research scene, and other donor agencies -- national and multilateral -- followed.
4. The agricultural research agenda in Africa is more varied today. Research continues in the traditional areas of cash and food crops, livestock, fisheries, and forestry. Even here research has broadened to include specialities such as dryland crops and irrigated crops. Agricultural research has also expanded from being primarily commodity based to include farming systems, environmental issues, erosion, and soil fertility. Training, too, receives much more attention today than it did when agricultural research began in Africa, and was the preserve of highly qualified expatriate scientists.
5. Today, the African research scene is complex and at times contradictory. Some governments endorse the importance of research as an instrument of development, for instance, but do not follow up with adequate research allocation. Local scientific capability has been built up in the context of a serious economic crisis and severe resource constraints. In short, increasing numbers of scientists have no money to work with.

6. Consequently, research institutions not only find it difficult to undertake or complete important research projects and programs, but are also unable to fulfill such routine obligations as publishing annual reports, recording research results, and important reference works like the inventory of indigenous herbal species in Ghana. The institutional memory of many years of work is lost or locked up in unpublished manuscripts. The reactions of most African researchers to this situation was expressed by a Cameroonian scientist who said: "When you know how much you can contribute, and when years are lost, you feel frustrated."

### AT A GLANCE: PROBLEMS, POTENTIAL AND OPPORTUNITIES

1. The African countries visited by the authors have a significant human-resource base in spite of attrition and inadequate incentives. Scientific skills need to be enhanced, however, and a planned effort is imperative to bridge the critical gaps. One path is through a "split degree," prepared jointly by a national governmental institution or university with an advanced university, international center or laboratory. This can be an effective mechanism for a long-term human-resources planning effort, so that a continued flow of research-scientists is available to fulfill requirements of the future.
2. Professional associations like the African Academy of Sciences are bringing together scientists, political leaders, financiers and entrepreneurs, and providing an opportunity to sensitize national decision-makers regarding the importance of science and research in development. Further, the Academy provides incentives to African scientists through recognition, fellowship awards and promotion of solidarity.
3. Regionalization is recognized as an important factor in utilizing the limited resources and expertise of the national scientists. Some national research and educational systems have evolved into regional hubs. Networking with dispersal of research-responsibility among national programs is a participatory approach favored by many national systems.
4. There is an evolving relationship within the global research system, among the national systems, International Centers, universities and institutions in the developed countries, and the private sector. A climate of interdependence is emerging with a clear recognition that different countries have different circumstances vis-a-vis physical and human endowment. The countries should have the opportunity to involve themselves substantially in the research efforts of the International Centers, may be, through advisory groups with adequate national representation. The Centers must also participate in the articulation of national research priorities and relating those to the Centers' global strategies.
5. The separation of research into upstream and downstream not only hurts the sensitivity of African scientists, but also impedes their access to advanced technology. Problems of patents, intellectual property-rights and high-cost need clear recognition. Equating national systems with the traditional and the routine, and international centers with the modern and the

challenging, is both unfortunate and illogical. The lack of interaction between international research centers and national universities is resented.

6. Smallholders and women find that they are the subject of much talk but very little action. Both groups face problems such as poor access to credit, input supply, a weak marketing infrastructure, and timeliness of payments due to them. In addition, women farmers have to grapple with a labor shortage, in communities where men are reluctant to work for women, and with complex tenurial difficulties. Investigation and policy analysis are required to deal with these issues.

7. Technical packages for mixed/relay cropping and other farming practices suitable for smallholders are inadequate. The farmers' efforts at conservation and sustainability, including home gardening, have only recently been recognized. Moreover, these farmers have accumulated a wealth of local knowledge on diversity, and on broadening the food base through a better use of traditional crops. This knowledge resource is untapped. Amalgamation of science with cumulative local knowledge requires location specific on-farm experimentations. The ecological approach of the farmers and of researchers and agricultural officers in the forties needs systematic assessment and expansion.

8. There is a significant potential for micro-irrigation as well as rich water resources in some countries, but insufficient research -- if at all -- has been undertaken in the areas of soil/water interaction, irrigation design, and water management. Universities with their disciplinary orientation can complement national/zonal commodity research institutions in such tasks of factor research.

9. The problem of research being largely oblivious to extension and to the farmers needs no repetition. The value, however, of a "filier" approach as in the case of cotton in francophone Africa or tea in Kenya is generally ignored. Such a single commodity approach has expanded in some countries into research-development linkages with food crops or with complementary tree-crops.

10. The inauguration of an African information network would be both cost-effective and efficient as a start to the long-term goal of building an adequate information infrastructure, which is sorely needed. However, this requires sustained external financial and technical support, based on partnership.

11. Lack of stable financing, both domestic and external, is a serious threat to the development of research in Africa. Domestically, funding is inconsistent and inadequate. Salaries are static, and payments are delayed. Governments faced with structural adjustment give low priority to research. External funding is unstable because of the limited time horizons of project cycles. Some research institutions work at less than 25 percent of capacity in the period between the end of one cycle and the beginning of another.

12. Inconsistent project funding fragments national institutional capacity and dissipates scarce resources. Conversely, the Grains Development program

in Ghana and the Cereals research program in the Cameroons are examples of the success achieved when funding is sustained over a long period.

13. A total dependence on external financing for operational costs of projects results in low productivity when the funding stops. In that context, partial loan-financing of national research programs/projects as contrasted to grant-financing of international centers is considered by some as discriminatory.

14. The mechanisms of external funding also have an important impact on research. For instance, pre-financing of research projects by national governments, with later reimbursement through external financing, is cumbersome and leads to slow disbursements and very little progress.

## RECOMMENDATIONS

The problems are many, but there are also grounds for optimism. In the hope that concrete action will be taken, this report limits itself to four recommendations.

1. A partnership between national institutions and external organizations is an essential pre-requisite for success in strengthening African agricultural research. As a move in this direction, it is recommended that a steering committee headed by a national for each National Research System be established. The steering committee should comprise representatives of the Ministry of Finance and/or President's Office, the National Research System including Universities, private sector/parastatals, development agencies, NGOs, regional organizations, CG centers, and donor-members of SPAAR. This committee will identify critical gaps and constraints both in human resources and institutional development; help collate past research which can have the potential for significant development impact; facilitate linkage between research and development; and optimize scarce resources by taking into account research programs of neighboring countries, regional initiatives, relevant international centers and the private sector. In addition, SPAAR could serve as a conduit for communicating national priorities to donors, international centers, and private sector research institutions in industrialized countries.

2. Dependency on external funding will continue. That being the case, the financial base for agricultural research should be expanded by the creation of a national endowment fund that could utilize counterpart funds from food aid. National research systems should also be encouraged to undertake research programs potentially capable of yielding quick results as a means of attracting more political support both nationally and from abroad for research. It is also recommended that SPAAR reviews the possibility of mobilizing long term support for designated national institutions.

3. SPAAR should also consider the establishment of a modest "bridge fund" to ensure that research in national priority areas would continue during the period between project funding cycles when the absence of cash flow sometimes brings research to a halt.

4. Regional initiatives based on national priorities and demand are an important element in strengthened African research. The program for maize and cassava in 11 African countries proposed by national systems, set in motion by the CGIAR Task Force and backstopped by IITA illustrates the point. It is recommended that other such regional initiatives be supported by SPAAR. It is, however, imperative to nurture this evolution by strengthening the national systems rather than by imposing regional institutions that have no national roots and are not supported by regional consensus.

## CONCLUSION

The conclusion is a mixture of hope and concern. Has the African research scene arrived at a turning point or will tokenism continue? If none of the above steps can be taken, it is seriously recommended that the national institutions be left alone to fend for themselves, and SPAAR continue as a forum for donor consultations. The authors hope that SPAAR, the international centers, and the national systems have all arrived at a pro-active turning point.

## INTRODUCTION

The need to integrate national perceptions with donor discussions and initiatives was emphasized by Dr. W. David Hopper, chairman of the Special Program for African Agricultural Research (SPAAR), in a letter to appropriate officials of the five countries covered by this report. SPAAR could not fulfil its objectives unless that integration was achieved, he pointed out.

In keeping with that rationale, this report aims to present as accurately as possible the views of national policy-makers, researchers, educators and development practitioners in Senegal, Mali, Ghana, Cameroon, and Kenya, interwoven with brief personal observations by the authors.

The assumption is quite straightforward. To plan and to plan together all the actors should have a similar understanding of what is being planned. It seems critical therefore that the donor community has the opportunity to see what the views of the national actors are and to see these in detail with the nuances that the nationals seek to project.

The report thus has taken on a "forum" function. The readers should have the opportunity to examine the situation nearly firsthand. Author's perceptions, rather brief, are presented at the end of each country report. A strong preference would be that the audience pays attention to the views of the actors rather than the commentaries. Very often, policy-makers in developing countries have to bite their tongue and go with the flow. This has led to many false starts. The authors would like this report to be an exception to that pattern.

Authors visited three West African countries - Ghana, Senegal and Mali between November 27 and December 15; and two others in Central and East Africa - Cameroon and Kenya between January 30 and February 13. They are deeply grateful to the nationals of the countries visited for their patience and insight. Directors and resident scientists of international centers, French research institutes, and non-government organizations as well as representatives of bi/multilateral donor agencies shared with the authors some of their concerns. Authors visited several research stations and development projects and saw some impressive micro-irrigation works organized by the farmers themselves.

The following is an account of what the authors heard and saw. Nobody can be completely objective. However, Alistaire Cooke makes a distinction between a hedgehog and a fox. The hedgehog wants to see the world ordered the way it ought to be. Foxes are more excited by the way life is with all its contradictions. Authors have tried to be with the foxes and do a fair report.

**SENEGAL: (NOVEMBER 27 - DECEMBER 1)**

Dr. Moctar Toure, the outgoing Director General of ISRA and now the Executive Secretary designate of World Bank's Special Program for African Agricultural Research (SPAAR) discussed the proposed five year program (1989-1993) for the Senegalese Institute for Research of Agronomy (ISRA) now under negotiations with the World Bank, USAID, France, the European Economic Community (EEC), Belgium and the International Development Research Centre (IDRC). The program, estimated to cost about \$100 million, was collectively designed by the scientists of ISRA, the extension personnel of various rural development agencies (working by region or commodity), the agriculture faculties and researchers of the university, and the policy makers in the ministries of Rural Development, Environment and Natural Resources, Animal Production, Finance, and Planning. According to the proposed program one-third of the cost would be borne by the Government of Senegal; one third by a World Bank/IDA loan; and one third by USAID and France together with donors such as the European Community, Belgium, and IDRC. Donors other than the World Bank and USAID have not agreed to make commitments beyond a time frame of two to three years. The increased commitment of Government investment will mainly cover the expenditure on salaries of the national staff. The uncertainties of longer term donor commitment as well as other issues such as funding to build ISRA Headquarters in Dakar have led to further scrutiny and scaling down of the future program in consultation with the World Bank and other major donors.

Dr. Toure particularly underscored two points:

- 1) the proposed program-priorities have been defined by the Senegalese themselves, on the basis of intensive internal discussions and review;
- 2) for the first time in Senegal's experience, the program has tried to establish a balance between production systems research and commodity-research, in food crops, export crops, tree crops, livestock, fisheries and forestry.

He also<sup>1</sup> briefly outlined the historical evolution of the Senegalese research system.

<sup>1</sup>/ For an incisive discussion on Resource Allocation and Crop Priorities, see Sidi C. Jameh and Uma Lele; Building Agricultural Research Capacity in Senegal, Draft, June 20, 1988, pp. 103-115. Also Carl Eicher, A Mid-term Assessment of the Senegal Agricultural Research Project: Lessons for Donors, May 20, 1985 p. 8, quoted by Jameh and Uma Lele, p. 131.

## EVOLUTION OF RESEARCH

Agricultural research in Senegal was a French implantation beginning with groundnut at Bambay in 1921 which eventually expanded to include sorghum and millet and became the Federal Center of Agronomic Research for the French colonies in West Africa in 1938. At independence in 1960, the Government of Senegal established a national agronomic research center (CNRA) at Bambay in place of the defunct federal center and the management of the center was entrusted to the French Institute of Tropical Agronomic Research (IRAT). The first unit of Animal production and Veterinary Research was established in 1935. At independence, the management of veterinary research was vested with the French Institute for Livestock and Veterinary Medicine for Tropical Countries (IEMVT). Fisheries Research, mainly Marine Fisheries, was initiated by ORSTOM (Office de Recherche Scientifique et Technique d'Outremer) in 1960.

Forestry Research is the youngest unit in ISRA, initiated in 1965, and managed by CTFT (Centre Technique Forestier Tropical) till 1974. ISRA was established in 1974-75 containing all the four units but with only nine (9) national scientists. Between 1975 and 1981, the main actors on the research front were the Government of Senegal and the Government of France. Part of the salary of the scientists and almost all of the operational cost was paid by the French. By 1981, the research system had 32 national scientists and 93 expatriates. These numbers are exclusive of a large ORSTOM/IRAT set-up.

The World Bank and USAID entered the Senegalese research scene after 1981. The early 'eighties also saw the expansion of scientific linkages between the Senegalese research system and international centers in the CGIAR family, mainly with IITA and ILCA, and later with ICRISAT and CIMMYT. Linkages with WARDA and IRRI began in the 'seventies.

Dr. Toure described the period between 1981 and 1985 as one of disarray and reorganization, of destabilization and conflict; of contradictory visions and management methodologies pursued by various donors. The rapid expansion of ISRA despite budgetary contraction due to structural adjustment, the rising debt burden of the system as well as the construction of a research monument at St. Louis led to serious conflicts. The fact that administrative fiat overwhelmed the scientific management of research coupled with over concentration on the form rather than the substance of research added to the disarray. In this situation, networking between strong components of the international research systems and a fragile national system advanced the international agenda but diluted the national capacity to formulate and pursue national priorities.

Consider, for instance, the consequences of USAID advancing the cause of Farming Systems Research and a Central Macro-Economic Policy Unit. Earlier, there was no institutional link between on-station research and farmers, except in a few instances such as in the cultivation of groundnut and cotton, and USAID's proposition was per se a move in the right direction. But the result of USAID's well-meant innovation was to create an imbalance in the research system. Production or Farming Systems Research backed by funding

from USAID and technical support from Michigan State University received the lion's share of donor funding -- as well as fleets of vehicles in Senegal, and opportunities for graduate training abroad -- while thematic research on crops, livestock and forestry was starved of operational funds, training opportunities and even mobility. As late as in 1985, for example, four of the six commodity research programs in Senegal did not have senior breeders while there were 32 farming-systems specialists backed up by expatriates in the central macro-economic policy unit.<sup>2</sup> Only oceanographic and marine fisheries research remained afloat with the consistent support of ORSTOM.

The imbalance was exacerbated by inadequate and erratic governmental contributions to the research budget while staff salaries were increased (in 1983) and the work force was bloated. The result was recurring deficits in the ISRA budget reaching about CFA 7 billion in 1987. Further, fragmentation and selectivity of research in terms of a donor driven policy agenda, and the existence of diverse accounting procedures with very little participation by national research managers, aggravated the "dependency syndrome" both in research management and in the formulation of a coherent, substantive research strategy and program. Nationally, hiring too many untrained staff was probably in response to the severe unemployment situation. Governments in Africa, like governments elsewhere, seek to retain political power, and featherbedding -- as a means of building political support for the Establishment -- is common on the continent as elsewhere in the world. When that happens, the demands of "political security" take precedence over rational management and efficiency. Politicization of the system also led to governments' investment in building ISRA headquarters in St. Louis at a cost of \$6 million. The building was later abandoned.

However, a multi-donor review of the system in 1986 led to some structural changes. The authority of the Ministry of Scientific Research to which ISRA had been accountable was phased out and the Ministry of Rural Development became the locus of ISRA, a shift that could strengthen the linkage between research and extension. Two other ministries relate to ISRA's animal and forestry research program, namely the Ministry of Animal Production, and the Ministry of Environment and Natural Resources. Out of 1500 staff members (of whom 32 percent were illiterate and 35 percent received basic education)<sup>3</sup>, 406 were retrenched in early 1987. Proper book keeping and an accounting procedure have since been put in place and ISRA is now a semi-autonomous agency. Still, the release of funds administered by the Ministry of Finance and Economy generally lags behind by six months and the financial autonomy of the institute continues to be constrained by agreements with donors or by immortal project guidelines laid down by donors.

The Institute today is no longer an administrative parastatal as it was before, but is managed by the scientists. Nevertheless, the continuous

<sup>2</sup>/ Carl Eicher: "A Mid-term Assessment of the Senegal Agricultural Research Project: Lessons for Donors", May 20, 1985.

<sup>3</sup>/J. Bingen and Jacques Fay "Organization et Gestion des Systems de Production au Senegal" August 1987

emphasis that donors have placed on a new organizational structure has had its cost in the departure of many experienced scientists. Concentration on administrative reform has also left some fundamental problems still unanswered. The integration of project specific rules and procedures into ISRA's financial management system has yet to be accomplished, for instance. And the uncertainty and limited time frame of both domestic and donor funding makes even medium-term programming a hazardous exercise. More particularly, the institute lacks a long-term human capital development strategy based on national priorities.

Today, ISRA has 115 national scientists and 48 expatriates as opposed to only 32 national scientists in 1981. But there are significant gaps, especially in water management, plant genetics, and agronomy. There is also need for graduate training on a long-term basis, and for the faculties of natural sciences, agronomy, veterinary science, and human sciences at the University at Dakar to be strengthened. Since 1987 ISRA has been forging a strong link with the University of Dakar. A number of agreements for contract research are being developed. Some animal scientists of the Directorate of Animal Production (DRSPA) are part-time faculty members in the University. There is also collaboration between DRSPA and the International Veterinary School located on university grounds. Five graduate students of the university are doing their field work under the supervision of ISRA scientists. The university has already set up a bio-technology center. Now under an agreement with ORSTOM a central laboratory for bio-technology is being established with ISRA, University of Dakar, and ORSTOM as partners.

## **NATIONAL/INTERNATIONAL INTERACTION**

Not surprisingly, in the context described above, Dr. Toure and his colleagues (Messrs. Ddiaga Mbaye, Deputy Director General, Limnamonlaye Cisse, Director Productions Vegetales, Aruona Geuye, Director Productions Animales, Papa Ndiengou Sall, Director Production Forestieres, and Papa Leopold Sarr, Director Farming Systems Research) all underscored the point that the senior national scientists, while aware of the need to borrow technology through international exchange, felt very strongly that they should participate directly in the production of technology. This has been a problem in the relationship between national scientists and the international centers. Authors were told that ICRISAT for example brought its own germplasm to be directly transferred to the African environment without first consulting national scientists who had been working on sorghum and millet for the particular agro-ecological and socio-economic environment of Senegalese farmers. The results of ICRISAT's program of germplasm transfer have been disappointing and, at least as significant, the program has created a sense of frustration among the local scientists who felt that they had been used as technicians and "free labor" for the implementation of an exogenous agenda. Developing a research agenda appropriate to the diverse agro-ecological and socio-economic environments in Africa depends on the capability of national scientists who are knowledgeable about and responsive to indigenous farming systems, practices and experimentation while at the same time participating in selective borrowing from the international bank of technology and science.

This can only happen if the emphasis is on partnership in research planning, design, implementation, and evaluation, between the national system and the international centers. The latter play the role of facilitators helping national scientists respond to national demands -- and building up national capacity as peers rather than as patrons. Dr. Toure and his colleagues also stressed the need for longer term commitment than now exists. There are other examples of the futility of quick-fixes without sensitivity to the farmers' socio-economic environment. These include the World Bank's Sine Saloum project which offered farmers technical packages that were "frequently not adapted to fit farmers' resources and conflicted with land use practices".<sup>4</sup> Another point to be noted is that in its dealings with international centers francophone Senegal has sometimes faced a language barrier, because some of their staff are monolingual English-language speakers.

Recently there have been some positive developments in the interaction between ISRA, on the one side, and IITA, ILCA, CIP, WARDA, ISNAR and IFPRI on the other. The CGIAR Task Force initiative on maize and cassava, stemming from national demand rather than from supply orientation has brought the IITA and national systems into a partnership rather than patron client relationship. ILCA has led networks on animal feed, small ruminants and camel, and pasture, and is helping build up national programs with the opportunity of exchanging research results with scientists from other West African, East African and southern African countries. Annual meetings and newsletters provide opportunities for such exchanges while paving the way for building up an African scientific community as part of a global research community of peers.

Forestry research programs which deal with tree crop and animal interaction in the groundnut basin, and in the sylvo-pastoral zone, could benefit from a closer relationship with ILCA. Collaboration with CIP/IITA on root tuber programs (potato and cassava) at the Center for Horticulture Development has led to an innovation in the regionalization of research. For here, a regional research mandate is being carried out through a national center. This type of practical arrangement, in which national and regional research interests are combined, may be a better alternative to donor sponsored regional institutions or networks among unequal partners.

Dr. Toure also emphasized the style and mechanism of the re-organized WARDA. The West African region feels involved in the governance of WARDA. The council of ministers provides the political linkage while national research leaders actively participate in WARDA programs. A similar relationship is evolving with IITA through the first ever meeting of some senior scientists of West and Central Africa held at IITA between January 20 and January 22, 1988, although the language barrier remains a problem. Senegalese research leaders expect a much bigger role by IITA in training program at the M.Sc/Ph.d level, and much closer collaboration with the

<sup>4</sup>/World Bank Operations Evaluation Study on Rural Development, 1965-86

University at Dakar. Collaboration now is marginal. It is expected that resident scientists and complementary research liaison scientists from IITA will provide a continuing relationship between ISRA and IITA.

ISRA scientists are working with other international centers for example with CIMMYT in maize and with ISNAR in research management and human resources development. The current program in maize is concentrating on a composite variety because of the difficulty of annual seed multiplication and distribution in the case of the hybrids, particularly when the new agricultural policy calls for public sector disengagement from input delivery. As for irrigated rice, the technology is available and has been widely adopted by the farmers. Unfortunately, there is pessimism about irrigation in spite of the potential in this area. The consequent lack of research focus on water management and on soil/water/nutrient interaction is a problem.. Currently, ISRA is planning to work with IIMI and WARDA in this field. Micro irrigation through public works and farmers organizations has not been looked at seriously in the St. Louis region. With the declining rain fall and its variability, irrigated agriculture becomes an important priority for national research from the points of view of available technology already adopted by the farmers and of immediate pay off which can stimulate political support for research.

## **POLITICAL SUPPORT FOR RESEARCH**

Political and administrative support for research formed an important part of discussions between the research leaders already mentioned as well as other relevant officials and the authors. The latter included Dr. Mouhamadou Diop, Director General of the Institute of Food Technology; , Mr. Kamara, Acting Director of Cabinet, Ministry of Rural Development; Dr. Mahawa Mbodj, Counsellor for Scientific research in the Ministry; Dr. Modou Mboup, Director of Scientific and Technical Affairs in the Ministry of Planning and Cooperation; and the Director of Agriculture.

Mr. Kamara asserted that the political environment for science and technology is as favorable or unfavorable as in any other country. The questions basically are first of demonstration of research results vis-a-vis real problems and second of research entrepreneurship in communicating with the political leadership. Some initiatives have been taken in this direction. The study on existing technology promoted by SPAAR in 1986-87 has revealed to many impressive research results in groundnut, cotton and rice. The physical results have been partly minimized by the external price factor of groundnut oil and cotton. The results have become visible due to the integrated effort of research extension and marketing in the case of cotton through SODIFITEX, the linkage between research and relevant development agency, that is, SODEVA for groundnut, and the working together of Farming Systems research teams and the development agency namely, SAED for rice. It may also be mentioned as pointed out by Dr. Mbodj that both SAED and SODIFITEX have been providing the farmers with inputs, credit, as well as the technical message. The most serious problem for the farmers is access to credit for inputs. The National Bank for Agricultural Credit was set up to advance credit to farmers

organizations, but in reality the small farmers cannot have access to loans because of their inability to raise the initial deposit of one-third of the amount to be borrowed. Land, not being privately owned, cannot serve as collateral. According to Dr. Sarr, Director of Farming Systems Research, only three out of 36 farmers group organized in the Casamance region could provide the necessary guarantee for obtaining credit.

The new agricultural policy which is disengaging agencies such as SAED from input supply (e.g. fertilizer) provides an interim measure whereby USAID will provide subsidies on fertilizers to be purchased with cash in the open market. Small holders simply do not have access to cash. At the unsubsidized price to be put into effect over the next year or so the use of fertilizer is clearly unattractive to small farmers.<sup>5</sup> The reform of the seed program, putting it into the hands of none too enthusiastic private traders, poses similar problems of access to credit. Without a specifically focussed policy for small holders credit, privatization alone may only consolidate the stranglehold of powerful organized groups like the Mourides (an Islamic sect) on access to massive amounts of "credit, land, machinery and other farm inputs"<sup>6</sup> and perhaps give them monopoly control over input distribution as well. The Government is considering the creation of a revolving fund for small farmers' cooperatives for use as collateral for credit. No extension methodology can work without first sorting out the small farmers' credit delivery system.

ISRA is participating in the evaluation of training-and-visit pilot projects with the World Bank. But as both Dr. Sarr and Mr. Kamara pointed out, research and development have been successfully linked in the case of irrigated rice where the regional farming systems research team, SAED, and the farmers are working together, or where as in the groundnut basin, teams of agronomists, animal scientists, foresters and economists interact with SODEVA and sometimes directly with farmers groups for an integrated tree/annual crop/animal system. In the Casamance region, for example, the ISRA farming system research team along with several research and education institutions are working directly with farmers' organizations in the Committee of Action for Development of Fogny (CADEF) project. Clearly, some research and development interactions are working in Senegal. Such successes are based on knowledge of the agro-ecological diversity and the mixed cropping tradition whose returns are about a third higher than from mono-cropping. While it is important to train the very often untrained and politically recruited extension workers, the imposition of "a" national extension system may, at least in the short run, subvert whatever impact research is having on certain export tree or high value crops.

An important area for research according to the Director of Cabinet of the Ministry of Rural Development, is declining soil fertility particularly in the acidic soil of the north. There is a pilot project with FAO/IFDC on

<sup>5</sup>/Sidi C. Jameh and Uma Lele, op cit June 1988 p. 61

<sup>6</sup>/Robert Bates, Essays on the Political Economy of Rural Africa, paperback, 1987.

treating such soil with natural rock-phosphate and calcium. Dr. Mahawa Mbodj thought that treating the acid soil on a large-scale every three years could be a viable project for the government both in terms of equity and sustainability. ISRA along with the university and ORSTOM has been working on biological nitrogen fixation with *Sesbania* and other indigenous shrubs. ISRA is also working on fertilizer response with the proper mix of minerals, chemicals, animal manure and legumes. Still, no technical package relevant to the resource-poor farmer is available.

Another major constraint to the diffusion of technology, besides the lack of a short maturing variety for important crops -- for example, sorghum -- is the weak infrastructure and inadequate marketing arrangements. A Senegalese farmer, who used an improved variety of pearl millet and some fertilizer one year abandoned it the next year, simply because with two women in the household, the marketing cost of the additional output was prohibitive. The Institute of Food Technology (ITA) established in the early 'sixties has only recently begun to grapple with the problem of on-farm storage losses, although it has done very impressive work on convenience foods for the growing urban population with traditional staples like sorghum and millet as also with fruits and vegetables, beef and fish. The linkage between such research results and local agro-industrial entrepreneurship is, according to the Director General of ITA, Dr. Diop, woefully inadequate.

The low productivity of research in Senegal, is also the result of the instability of both domestic and external funding. The Center for Horticulture and Development (CDH) off Dakar has done impressive work in both research and pre-extension with tomato, okra, onions, peppers etc. in collaboration with Belgium and FAO. Now that the earlier project agreement has concluded, the eight Senegalese scientists in the center along with a Belgian scientist are working at only 25 percent of capacity. A new convention is being worked out with Belgium, in cooperation with IITA and CIP for further work on cassava, potato and sweet potato. Continuation of the work on fruits and vegetables will involve other national systems in the region with technical assistance from CIRAD and ORSTOM. Creation of a new network of CORAF (the Conference of African and French research leaders) with central base in CDH is on the agenda of CORAF's March meeting. But the intervening period between the two project cycles is one of marginal productivity mainly due to lack of operational funds. Perhaps it would be possible for the donor community to devise a mechanism through SPAAR, for example, to provide bridge funding. Given the reality of project cycles of donors and the inadequacy of domestic funding particularly when public expenditure is being trimmed for structural adjustment, the importance of such bridge funding cannot be over emphasized in the interest of both the continuity of good research and of the productivity of African agricultural research.

Inadequate incentives, rewards and a high attrition rate (about 7 per cent annually in the case of Senegal) further reduces productivity. The Deputy Director General of ISRA, for example, told the authors that he was drawing almost exactly the same salary as he did in the early 'seventies when he joined the system. ISRA, in fact, has become a training ground for scientists who move on to greener pastures. The question of incentives and

rewards is now being discussed at the highest policy level. Aligning the research system's career and promotion prospects to those of the university may be an alternative but that would mean increased opportunities for first degree scientists in ISRA to pursue graduate studies. Policy makers like Mr. Kamara and the Minister for Rural Development, as well as senior officials in the Ministry of Finance and Economy are well aware of the problem. The bottom line is the availability of local finance.

## SUMMARY CONCLUSIONS

The agricultural research scene in Senegal is complex and contradictory. There is a growing number of confident and committed scientific intelligentsia on the one hand and a high attrition rate of experienced scientists from the system on the other. A moderate increase in domestic budgetary support for research is offset by the trimming of public expenditure due to structural adjustment. In spite of a large injection of external funds into the system, there is instability of such funding because of the limited time horizon of project cycles. Although consolidation of resources and balanced programming is evident, dispersal is sometimes thin due to too many donors pulling the system in different directions. A total reliance on external finances for operational costs results in low productivity of research when such funding stops. A large irrigation potential and availability of irrigated rice technology contrasts with the pessimism of the donors and a lack of indigenous capability for water management.

The limited availability of drought and disease resistant short-maturing sorghum/millet varieties, a paucity of technology for mixed cropping with cowpeas, and the credit, infrastructure and marketing constraints faced by small farmers adds to this complexity. The successful linkage between research and extension in cotton, groundnut or rice is offset by the predilection of donors to supplant that with new extension methodology that succeeded in the homogeneous environment of Asia. Networks led by international centers help build up the national capacity and break the isolation of national scientists, but supply driven attempts by some centers which divert resources away from the national system weakens this buildup. The national urge for linkage between governmental research systems and the university contrasts with the marginal interaction between international centers and the national university. National centers with a regional focus like the vegetable and fruit research station of Senegal CDH contrast sharply with the on again off again attempts by donors for regionalization that has little or no connection with the national system.

## MALI: (DECEMBER 1 TO DECEMBER 7)

El Hadj Omar Tall, Director General of Institut d'Economie Rurale (IER) and his colleagues at the IER headquarters opened the discussions with an overview of the research scene in Mali.<sup>7</sup> In his previous positions, as Minister of Natural Resources and Animal Production and as head of the Agricultural Development Bank of Mali, the Director General had close connections with farmers organizations and with the management of agricultural credit. His comments were therefore based on wide ranging experience.

### EVOLUTION OF RESEARCH

Agricultural Research was introduced by the French in 1927, beginning with the livestock research station at Sotuba which later became the federal center for francophone West Africa with sub-centers in Senegal and the Ivory Coast. In the early 'thirties the Office du Niger was established for the major irrigation project over the River Niger with a station for cotton research at Kayo. After World War II, agricultural research really matured in Mali, supported by and linked with research institutions of the colonial metropolis. The French Institute for Cotton Research established research stations in Kogoni (replacing the one at Kayo) and N'Tarala, while the Institut d'Elevage et de Medecine Veterinaire de pays Tropicaux (IEMVT) supported livestock research for the Sahelian zone.

After independence, in 1960, agricultural research -- agronomic, forestry, hydro biology and animal sciences -- was centralized under the IER in the Ministry of Agriculture. Agreements with French research institutions such as the Institute de Recherche en Agronomie Tropicale (IRAT), the Institut des Fruits et Legumes de Coloniaux (IFAC) and IRCT, consolidated crops, oilseeds and legumes research at Sotuba; rice research at Kogoni; fruits, vegetable and cash crop research at Bamako and Farako-Sikasso; and cotton research and development in the Mali-Sud region, at N'Tarala.

The sixties also saw the development of the Institut Polytechnique Rurale (IPR) at Katibogou and the Ecole Normale Superieure (ENS) at Bamako for training Malian scientists in applied agricultural sciences including agricultural economics and the basic sciences of botany, physiology, entomology, micro-biology, environmental sciences, and geography. A third institution, which is still very fragile, the Institut Superieur de Formation pour la Recherche Applique (ISFRA) was established in 1981 with support from UNESCO, to provide advanced training for the teachers of IPR and ENS. All three institutes function under the Ministry of Education.

<sup>7/</sup> The meeting with the Director General was attended by Messrs Dotianaga Diamoutoene, Deputy Director General, IER; Zana Sanogo, Director Agronomic Research; and Dr. Goita, director Farming Systems Research.

Linkages between the national research system and international centers (ICRISAT, ILCA and WARDA), as well as with regional initiatives like the Permanent Interstate Committee for Drought Control in the Sahel and the Regional Institute for the Sahel (CILSS-INSAH) or the Food Grains Research and Development in the Semi-arid Region (SAFGRAD), were forged in the late 'seventies. This period also saw the systematic graduate training of Malian scientists, organized and funded by the Ford Foundation over a period of five years and supervised by international centers. Short-term training continues at some international centers (e.g. ICRISAT in India) but the fact that trainees spend a third of the training period on learning a new language rather than on substantive work, dilutes the efficacy of such training.

A seminar on Farming Systems Research held at Bamako in 1976 led the way to the establishment of a West African Farming Systems Research Network which was institutionalized in the Sikasso and Bougouni regions with support from the Netherlands, and IDRC. Subsequently, USAID initiated a similar program in Bamako. USAID-funded on-farm trials were conducted by SAFGRAD. Meanwhile, the CRSPS and the consortiums of American Universities on sorghum and millet (INSORMIL) and tropical soil (Tropsoil) integrated successfully into the national system's strong sorghum/millet program backed by excellent laboratory facilities in soil. The split degree with field work in Mali and course work in American or French Universities is strongly supported by the Malian leadership and is the favored graduate training program for Malian scientists.

The EEC and the European Development Fund (EDF) had a major research and development program in fisheries in the MOPTI region. The only survivor of this program is the laboratory at MOPTI, with very little money for research. A new six-year program introduced by ORSTOM pays more attention to the traditions, credit and marketing practices and the socio-economic environment of the mobile artisanal fishermen of the delta than to biological research and innovation alone. The problem again is marginal participation by Malian scientists. Their involvement, moreover, lacks continuity.

Several members of the European Economic Community concentrates on irrigated rice. The EEC supports crop production, mainly rice, in the 50,000 hectares of irrigated land in Office du Niger. The EEC also sponsors micro-irrigation public works by the farmers themselves to increase the irrigated acreage, financed by counter-part funds generated through food-aid. Some of the dams and tertiary channels built by farmers organizations which the authors saw in Niono are indeed impressive and contradict the stories of poorly-built dams being washed away. An agreement has been reached between the governments of Mali and of the Soviet Union for the rehabilitation of 200,000 hectares of irrigated land. The World Bank has also agreed to an irrigation-rehabilitation project.

The World Bank entered the Malian research scene with research components in a project for the development of groundnut (OACV) to be followed by another project for adaptive research and extension methodology. The latter never went beyond the pre-feasibility stage. Recent efforts of the World Bank are, first, in revamping the national extension system beginning with pilot projects covering the training and visit System of extension in both rainfed

and irrigated rice areas and, second, in a diagnostic review and program planning for Malian agricultural research up to the year 2000 to be carried out in collaboration with ISNAR. The extension project is quite separate from IER and the Farming Systems Research. It is also separate from the successful pre-extension and extension efforts, including input delivery and marketing, of CMDT/IER in the cotton growing Mali-Sud region and of the Office du Niger.

The IER-ISNAR research review is in progress with five working groups composed of researchers and representatives of development agencies working on dryland crops, irrigated crops, the environment, animal production, and farming systems research. The problem according to the Director General of IER is that the focus is on commodity and thematic research rather than on farmers' needs and constraints. The complexity of the farming system with its diverse cropping for subsistence, cash and tree crop/animal interaction, calls for some re-direction away from single commodity, sole cropping, and food crop bias. For instance, the Dire Station for wheat has impressive research results for irrigated wheat but very little for the needs of farmers in Toumbouctou and Gao regions who grow millet, sorghum, beans, rice and other cash-crops. The Director General feels strongly that the under-researched areas of soil-water management, desertification, soil degradation, and non-traditional cash and exports crops including fruits and vegetables, require stronger emphasis. The fragmentation of research training and development follows the management structures of powerful donor organizations. Extension and research efforts are strictly compartmentalized; and educational projects, so far, have had very little interaction with national research needs and priorities. The sectoral orientation of international organizations reinforces the line ministry autonomy in developing countries.

## SOME DOMESTIC DEVELOPMENTS

An account of the evolution of Malian agricultural research is not complete without some reference to domestic initiatives in research organization and of aborted regional research efforts. In the early eighties the Ministry of Agriculture was reorganized and a new Ministry of Natural Resources and Animal Production was created. In 1981 the responsibility of research on animal sciences, hydrobiology and forestry was vested in a new research institution, the Institut National de la Recherche Zootechnique Forestiere et Hydrobiologique (INRZFH). Recently, the Government has made a policy decision to integrate INRZFH with IER, but the two ministries continue to remain separate. The two institutes however work closely together and define their program and themes for research through annual meetings of Commissions Techniques Specilisees (CTS).

The relevance of agricultural research to development needs is determined at the level of the interministerial Agricultural Research Council (CNRA: Comite National de la Recherche Agronomique). A new research coordinating body, CNRST, will soon be established to improve inter-sectoral linkages and to consolidate the education-research-development continuum. Dr. Cyr Mathieu Keita, Director of Cabinet in the Ministry of Education hopes that as this national co-ordinating council becomes operational higher education will be

integrated with the national research system. At the moment, the linkage is informal.

The Director General of IER is a leading member of the Academic Council of the IPR. Some researchers in the national system also teach at educational institutions. Geographers from ENS have helped IER in land use studies and environmental characterization. Students of the Polytechnic conduct field work at research substations for their degree/diploma requirements. However, travel and maintenance funds for these students are inadequate. Graduate studies and specialization by Malian research scientists are basically supported by the US and France in their respective universities. IPR, however, has a strong link with the Soviet Union for the advanced training of its faculty members and students. ISFRA, without much of an infrastructure, has taken some tentative steps to conduct graduate studies within Mali for faculty members of educational institutions.

#### EXTERNALLY GENERATED REGIONAL INITIATIVES:

The two most striking examples of regional initiatives in research are the station for Senegal Valley Development (OMVS) at Same, and the US funded CILSS laboratory for phytopathology and entomology at Sotuba. The former despite all its facilities for irrigated and dry land crop research is a deserted edifice with no budgetary or scientific resources for research. The maintenance of the station is an unproductive drain on the inadequate national budget for research. The well equipped laboratory at Sotuba designed to reinforce the national program for research on controlling disease and weeds in the production of millet, sorghum and soybean shrank to a facility of two scientists, as soon as USAID stopped funding CILSS. Similarly the still active rice research station at MOPTI has some specialized scientists, but with the withdrawal of WARDA since the organization downgraded research on floating rice, there has been almost no funding for research. The Director General of IER is negotiating with UNDP to obtain germplasm and some operational funds.

National stations which were financially and scientifically led by international centers faced serious problems when external finance was withdrawn. The Sahelian station for zootechnique in Niono, which the authors visited, was supported by ILCA from 1976-88 with resident scientists and research funds. The station, the second largest animal research station in Mali, had been working on animal based production systems, improvement of pasture (at the moment 12,000 hectares of pasture land is utterly degraded in the zone), animal nutrition, agrostology, meat and milk production, small ruminants etc. Now, 15 post graduate and graduate scientists with more than double that number of technicians as well as other staff have very little work. Even marginal funding for micro computer facilities to store the massive data collected over more than a decade of work is not available.

The withdrawal of USAID-ICRISAT support for the excellent work being done at Cinzana, on millet and secondary crops, would have had similar results but for the continued financing from CIBA-GEIGY and some support from the national

budget. Cotton research or adaptive "rice" research in the Office du Niger have been insulated from such misfortunes because of continued support from the French and the EEC respectively and of the integration of research and input delivery, extension and marketing. Many parastatals, particularly marketing boards, which have been inefficient are being phased out over six difficult years of structural adjustment in Mali. But how can a government link the local knowledge of resource constrained farmers with relevant science and technology in the absence of a stable credit delivery system, and a viable private sector for input distribution? This problem is aggravated by a weak marketing structure coupled with high transportation costs.<sup>8</sup>

### STRENGTHS, CONSTRAINTS, AND NEEDS

The obvious strength of the Malian national system is its scientific and intellectual capacity. According to an ISNAR study by John Casas, there are 290 nationals active in research with another 20 currently in long-term training in the US and France. Educational institutions under the Ministry of Education and the Institute of Human Sciences under the Ministry of Culture have more than 110 scientific personnel in biological and social sciences. More than a third of the scientists in research institutions and development projects and more than half the professionals in educational institutions have post-graduate degrees. There is also a critical mass for commodity research. The problems are that the scientists are thinly spread among regional research stations and sub stations which follow political and administrative boundaries rather than agro-ecological ones. There is also an imbalance between intra-commodity/inter-commodity and disciplinary programs.

Mali has impressive research results in cotton and irrigated rice although the search for a short-maturing rice variety to enable a second crop without the problems of cold spells at night and bird attack still continues. Mali is also the lead country in the West African Sorghum Research Network. In both sorghum and millet, research products for stability, drought and disease tolerance are available, although no miraculous yield increase has yet been seen. Locally improved and introduced varieties of corn and cowpeas have

8/ The overview presented above is a synthesis of discussions by the authors with Malian scientists and policy-makers. They include beside the Director General of IER and his colleagues: Dr. Cheick Cisse, Director General, International co-operation, Ministry of External Affairs; Mr. Mamadou Outtara, Deputy Director General, INRZFH and his colleagues in forestry and fisheries; Dr. Mamadou Toure, Regional Director CMDT at Koutialla; Dr. Meme Togola, Director of Zootechnique Station at Sotuba, Directors of Cabinet of the Ministries of Education and Agriculture among others. Authors also gained from the insights of Mr. Tracy Atwood of USAID mission in Mali, Mr. Yves Gezzo, delegate for the EEC and ORSTOM teamleader for the MOPTI project. ISNAR analysis by Joseph Casas, August 1988, has been particularly helpful. Authors' perception gained from terrain visits to Segou, Niono, Koutiala, Cinzana and Sotuba also inform the above.

shown increased yields. In the Mali-Sud cotton region, a maize-millet intercropping system with short maturity corn and long duration millet following and exploiting the residual fertility of the pure cotton crop is being widely adopted by the farmers. In other words, Malian research has produced results and Malian scientists are capable of technology development as well as technology adaptation.

Mali, no less than Senegal, faces the problems posed by erratic funding, an overwhelming dependence on aided project cycles, and a distorted distribution of scientific and financial resources among programs. Allocations are decided upon by bureaucrats in the Ministry of Finance and Economy. Scientists engaged in field research need mobility, but the purchase of vehicles is forbidden and funds for the recurring cost of oil and fuel are barely adequate. Within the DRA, the fruits, vegetable and cash crop research programs suffer from a chronic lack of funds. There is almost no external support except for some funding from GTZ in Dogon county for small dams and irrigated onion. Further, some of the sub-stations are unsuitably located either in regard to soil type or in access to transportation. Maintenance of such sub-stations causes an unnecessary drain on already meager funding.

Tobacco and tea research are limping along with support from the production parastatals. Cotton, of course, has no problem with funding and benefits from a strong linkage between the CMDT and the IER through "Reunion de concentration CMDT-IER." The research demand is generated by the parastatal for cotton production and marketing in close cooperation with the Farming Systems Research teams, and is responded to by researchers in DRA with pre-extension work done by DSPR (farming systems research). The same is true in the case of the Office du Niger which has its own complement of scientists for adaptive research, both national and expatriate.

Farming Systems Research, however is almost totally dependent on external resources. The impressive work which is being done in Sikasso and Mali-Sud region will come to a halt once external funding stops. There are also other constraints. As Mr. Bokary Sanogo coordinator for Farming Systems Research told the authors, with a total freeze on recruitment of researchers, the research-teams very often cannot have all the specialists they need, namely agronomists, animal scientists, foresters and economists, including women researchers. Sometimes they recruit, using project fund. In the process researchers trained during a project cycle are lost to the system, when the project is completed or terminated by the donors. The anti-erosion work that is being done with the farmers on their own fields in the Kaniko Valley, by planting rows of cotton plant stems or building low stone dams against run offs during the rains, is completely dependent on funding by the Netherlands with a number of researchers recruited temporarily from project funds.

A problem of interaction between research and development for anti-erosion work is the labor constraint of the farmers and the incursion by pastoralists with their cattle during periods of drought. The need, according to Mr. Sanogo, is for a holistic understanding of tree/animal/crop interaction in southern Mali with reference to the traditional relationships between the pastoralist from the north and the settled agriculturists. These relationships have recently been skewed because more and more farmers have begun to own

cattle for traction and intensive farming. Another problem, in the context of Farming Systems Research, is that the funding principles which guide donors and the needs of the system do not always coincide. The Farming Systems Research unit at Bougoni, for instance, suffers from poor infrastructure but the main donor does not, as a rule, finance the development of infrastructure. The contradiction between unutilized and under utilized infrastructure in some stations and sub-stations and the lack of infrastructure in others is quite distressing.

The lack of housing and related facilities might be one of the reasons why there are only a few researchers at out-of-town research stations. The Cinzana station off Segou has only three resident scientists. Other specialists visit infrequently from Bamako, 250 kms away. Free housing, electricity and water will attract more scientists away from Bamako, where they rent their houses with rather inadequate salaries. Again, donors are willing to invest on research stations or other buildings but not on housing facilities for scientists needed at field stations.

Another obvious reason for the over-concentration of researchers in Bamako is that many need to take on a second job because they cannot cope with the high cost of living on what they earn as researchers, and it is easier to find additional employment in the capital than in remote areas. Beside, administrative positions are more remunerative than those of scientists. Mr. Panagainguou Dole, chief of crops, oilseeds and legumes section in DRA also serves as the Director of the research station at Sotuba.

The problem is much worse for research programs without external support. INRZFH (with more than 300 staff members of whom 90 are senior scientists) receives little external funding and suffers continuously from uncertain financial conditions. Some external research support is available -- mainly from USAID, France, and ILCA --but about two thirds of the Institute's research program is funded by the national budget. The instability of funding worsens when disbursements for meeting the operating costs of the Institute's regional stations are controlled by regional administrations.

## SUMMARY CONCLUSIONS

The paradoxes are obvious. The goal of building adequate scientific capability is undermined by a lack of a well defined and continuing program for upgrading the specialized skills of scientists. The higher cost of research in Africa contrasts with the very modest remuneration which Malian scientists receive. While a critical mass of scientists is available, their thin dispersal over many stations/sub-stations without financial support for research diminishes their effectiveness.

Field stations are understaffed, mainly because they lack proper housing, and there is an over concentration of human resources at headquarters and at nearby stations. The potential for generating new technology backed by excellent laboratory facilities is jeopardized by the uncertainty of national funding and instability of project aid. Donors emphasize food crop research

and fail to recognize the potential of high value cash and export crops, including the industrial promise of traditional crops. There is an excess of under utilized research stations/sub-stations located in terms of political and administrative boundaries whereas the real need is for adequately staffed production system research in different agro-ecological zones. The growing strength of on-farm adaptive research is not matched by mechanisms for integrating thematic research into local farming systems. The need for a steady supply of water for seed fertilizer technology is not matched by a research thrust into surface and ground water potential.

Excellent scientific work is being done on agro climatology in Mali with support from CIRAD/ORSTOM, and there is accumulated knowledge of irrigation technology in the Office du Niger. However, there is a surprising absence of any systematic assessment of micro-irrigation potential among the farmers themselves or of local water harvesting technology as practiced for example, by the farmers in Dogun, who collect rain water in the hollow of tree trunks. Extension methodology, rather than the training of extension agents is emphasized. A purely theoretical focus on small farmers has caused a lack of policy research on their production and marketing constraints, particularly in regard to women farmers or women heads of household. There is a pressing need for priority research on, and scientific and financial support for, post harvest technology to reduce avoidable food losses. The list could be longer but, as in Senegal, stable finance continues to be a fundamental need.

However strong its political will might be, a Malian government engaged in structural adjustment under extremely difficult economic conditions cannot bear more than a marginal share of the cost (e.g. the salary of researchers) of sustained agricultural research. Thus, donor support remains vital, if the continuity of research is to be ensured. The direction of donor support needs to be carefully assessed in terms of Malian realities, on the basis of priorities set by national scientists and policy-makers, and taking into account the various assessment of African agricultural needs already made. In this connection, it is useful to recall Michael Lipton's assessment that "for most of Sub-Saharan Africa seed fertilizer technology is the only thing on the horizon that can produce the big increases" and that depends on irrigation and water security. "Who can expect enthusiasm for agricultural research, agricultural investment or farm policies either from farmers or from governments (a) on the base in a normal year of badly watered holdings, let alone (b) during a drought in which the returns to past agricultural investments are slashed due to lack of irrigation? Can the political will to finance agriculture be mustered if agriculture is so often wiped out by drought?"<sup>9</sup>

<sup>9</sup>/Lipton: The Place of Agricultural Research in the Development of Sub-Saharan Africa (mimeo graphed). Paul Richards in *Indigenous Agricultural Revolution* (1985) refers to some major techniques for micro-irrigation in West Africa, namely estuarine cultivation, flood plain and valley bottom (including flood retreat and flood advance methods), and run-off (seep zone) cultivation. Rather than attempting to transfer labor intensive Asian models of minor irrigation, extension and improvement of techniques indigenous to Africa may be a better approach.

Furthermore, diverse and mixed production systems in a fragile environment call for a realignment of research in conformity with agro-ecological zones. Technology development should be based on farmers' needs and therefore should concentrate on on-farm research linking local knowledge and experimentation with scientific innovation. As a corollary to that, the constraints of inadequate credit marketing and infrastructure have to be better understood and kept in perspective.

Finally regionalization without integration into the national system, besides being short-lived and supply oriented, causes unnecessary strain on the national budget for research.

## GHANA (JANUARY 7 15)

Dr. Atta Konadu, Chief Director of Agriculture, Dr. Samuel K. Dappa, head of the Policy Planning, Monitoring and Evaluation Department of the Ministry of Agriculture Dr. Baffour Badu Aprapu and Dr. Abutiare of CRI, were among many of the scientists and officials that the authors consulted with for the following assessment of the state of agricultural research in Ghana. Dr. R.J.C. Butler, Director General of the Council for Scientific and Industrial Research (CSIR) and Mr. Haruna Maamah, responsible for agricultural policy in the Ministry of Finance and Planning, provided valuable insights. Authors are deeply grateful to the Honorable Steve Obimpeh, Minister Agriculture for his profound observations and pragmatic insight.

## EVOLUTION OF RESEARCH

Agricultural Research in Anglophone Ghana, as in Francophone Senegal or Mali, was dominated by the "mother" country's special interest in export crops such as cocoa, oil palm and industrial timber. Similarly national research was linked to the metropolis and to the region as a whole. Ghana, for example, was the Federal Center for Cocoa research in West Africa. It was only in the aftermath of severe taxation of cocoa, payment by chit system to disorganized small-holder cocoa farmers and overvaluation of currency for rapid industrialization that the Ivory Coast replaced Ghana in the world cocoa market.<sup>10</sup>

It is worth noting that the development of cash crops, like cocoa in Ghana has been an indigenous initiative. Cocoa was introduced to Ghana by a migrant returning from Fernando Po.<sup>11</sup> The reports of the West African Commission on crop production, soil fertility and live stock in 1943, were instrumental in the increased attention to food crops and veterinary research. This also led to a new ecological approach to understand the local production-

<sup>10</sup>/ ISNAR Working Paper No. 9, May 1988. Small-holder cocoa farmers in Ghana had no influence over policies of the post-independence government while Syndicate Agricole Africain in the Ivory Coast was basic to the creation of the inter-territorial political party that brought French West Africa to independence. In such cases of weak constituency, donors can indeed play a part in policy dialogue as they have in Ghana, for cocoa-rehabilitation. A stark contrast is misplaced enthusiasm of the developed world regarding highly subsidized large scale mechanized rice farming in Northern Ghana reinforced by import restriction and high procurement price as is evidenced in K. Hart's, *The Political Economy of West African Agriculture*. The swings in the pendulum of donor-perceptions may sometimes breed unnecessary national confusion.

<sup>11</sup>/Paul Richards, 1985, *op cit*; and P. Hill, 1963, *The Migrant Cocoa Farmers of Southern Ghana; a study in Rural Capitalism*.

system where successive crops are planted in rotation to ensure that the soil is always occupied and is neither dried out by the sun, nor leached out by the rain.<sup>12</sup> In fact, in the early 'forties, a number of colonial agricultural officers in Northern Ghana, had been patiently conducting base-line studies on indigenous knowledge and the farmers' own practices and experimentations. This is the single largest knowledge resource, not yet mobilized in the development enterprise.<sup>13</sup> It is interesting to note that after two decades of a transfer of technology, and single crop options, some biological and social scientists are seriously looking at mixed and inter-cropping for stability and sustainability in production as well as for a smooth labor profile and return to labor. Further, alley cropping or minimum tillage are now respectable terms in the scientific and development lexicon.

Immediately before and at independence, agricultural research in Ghana was carried out by the Specialists Branch of the Agriculture Department with stations and field stations in all agro-ecological zones. According to Dr. Atta Konadu these zonal stations were the radiating points for adaptive trials, extension and diffusion. Researchers and extension workers were trained together in the universities and thereafter on the stations. Well established universities, such as the University of Science and Technology at Kumasi or the University of Ghana at Legone also conducted agricultural research and were integrated into the national research extension system. Further, the universities helped in the rapid indigenization of national research, inspite of large scale attrition in the late 'seventies and early eighties due both to economic malaise and a lack of reward and career structure. In 1970, for example, 46% of all agricultural researchers employed by the Government of Ghana were Ghanaians. In 1983 the figure rose to 90% compared to only 23% Ivorians in agricultural research and training in Cote d'Ivoire.

## RESEARCH AND EXTENSION

The strong linkage between training, research, and extension started going adrift in the 'sixties. Many of the research stations or parts of them were converted into State farms, and research and extension were separated. At the same time, an almost single-minded emphasis on large scale mechanized farming of rice, for example, diverted resources away from the diverse production needs and constraints of small farmers.

The story of national agricultural research in Ghana, through the 'sixties and 'seventies till now can be briefly summarized as follows. The National Agricultural Research Council established at the highest political level after independence, was merged with the Ghana Academy of Sciences, in 1963. The National Academy was reconstituted in 1968 into the Ghana Academy of Arts and Sciences (a learned society) and the present Council for Scientific and Industrial Research (CSIR). The latter under the Ministry of

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<sup>12</sup>/Ibid: quoted from Howard Jones: *The Earth Goddess: A Study of Native Farming in the West African Coast*, 1936.

<sup>13</sup>/Robert Chambers, *Rural Development: Putting the Last First*, 1983.

Industry, Science and Technology is responsible for co-ordinating all scientific research-agricultural, industrial, water resources, roads and buildings. Forestry Research is separate under the Forestry Commission in the Ministry of Land and Natural Resources. The Cocoa Research Institute is directly linked to the Ghana Cocoa board (COCOBOD) and works on cocoa, coffee, cola and shea nuts.<sup>14</sup>

The Agricultural Research institute set up in 1963 was subsequently split into two units and by 1964 were set up as two full-fledged institutes, the Crops Research Institute (CRI) and the Soil Research Institute (SRI). The CRI is responsible for research on all food-crops, fruits and vegetables, legumes, fibre crops and oil seeds except for oil palm. Located at Kwadaso, 10 kilometers from Kumasi, the CRI has four (4) stations and nine (9) sub-stations distributed through all the agro-ecological zones of Ghana.<sup>15</sup>

Researchers are unevenly distributed in different stations and among programs. Further, the proliferation of scientific investigations (around 60 according to the CGIAR Task Force Report) results in a rather thin and

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<sup>14</sup>/Currently, the Council co-ordinates research programs and functions of the following institutes:

A. Agricultural:

- Crops Research Institute Kumasi
- Soil Research Institute Kumasi
- Oil palm Research Centre Kusi
- Animal Research Institute Achimota
- Institute of Aquatic Biology Accra
- Food Research Institute Accra
- Water Resources Research Institute Accra
- Herbs of Ghana Project Legone

B. Others:

- Industrial Research Institute Accra
- Building and Road Research Institute Kumasi
- Scientific Instrumentation Centre Accra and Ghana National Atlas Project.

<sup>15</sup>/The stations for the coastal savannah zone are at Ohawu and Pokoase; for the semi-deciduous forest zone, at Bunso, which is also the germplasm and genetic resources center supported by IBPGR; and for the high forest zone at Aiyianse. The sub-stations are at Damongo and Yendi in the Guinea Savannah, Manga in the Sudan Savannah, Kepve in the Coastal Savannah, Ejura in the transitional zone, Akumadan, Asin Foso and Buako in the semi-deciduous forest zone and Princess Town in the high forest zone. New facilities for the CRI is being built at Fumesua, with 280 hectares of land.

therefore less productive spread of resources. The only full-time researcher on cassava based at Ohawu has no vehicle, no fund for on-farm trial and no linkage with the semi-autonomous, World Bank supported Volta Regional Agricultural Development and Extension Project (VORADEP). Similarly, there is only one agricultural economist, now working for his M.sc degree abroad, in the CRI, although there is a sizable Farming Systems Department at the Nyankpala Agricultural Experiment Station Project which is supported by German funding and has a German economist. The problem is that such support including that of visiting scientists from the CIMMYT can only be a short lived substitute for and may detract from, building indigenous capability integrated into the national system.

There are other examples. For instance there is only one researcher on post-harvest losses, at the Pokoase station with minimal linkage to the work being carried out in the Food Research Institute in Accra. The Ministry of Agriculture has also quite recently set up, a Post-harvest Development Unit (PHDU) which is being strengthened with UNDP support. Again, there is only one junior research officer in Agricultural Statistics. Reasonably reliable and timely information is required both for an overall policy framework and for a meaningful dialogue between researchers and policy makers. A project for strengthening agricultural statistics has been initiated in the Ministry of Agriculture with support from the UNDP/FAO. The project-by-project approach however, may not be conducive to building up coherent national capability through the establishment of institutions, necessary policy analysis and an information capacity within the research system. Besides, relatively autonomous project entities may pose difficulties for their integration into the national administration system.

The paradox of such an approach becomes painfully and expensively obvious in semi-autonomous and apparently successful integrated agricultural development projects like the Upper Region Agriculture Development and Extension Project completed in 1985 with an investment of 21 million dollars from the World Bank and the ongoing Volta Region Project. VORADEP is a large integrated agricultural development project which includes components such as feeder roads, water supplies, veterinary services, and fisheries etc. It is a semi-autonomous body within the MOA, has a large component of adaptive research, runs its own extension service with 300 agents, is developing two stations for on station research and has developed formal links with IITA. But, it has no links with the cassava work, conducted however inadequately, at the CRI station at Ohawu or for that matter with the national research system. Such well intentioned efforts may succeed in achieving short term production goals, as VORADEP has indeed succeeded in the multiplication and diffusion of improved varieties of cassava or of yam minisett multiplication technique. But it diverts resources away from the national system, retards internal development of scientific capability, causes frustration to the minimally supported national researcher in the CRI and fragments the fragile linkage between research and extension within the country. Moreover it has very little domestic support from the national scientific community.

Examples of externally funded but nationally integrated research and extension efforts are the Ghana Grains Development Project (GGDP) and the Nyankpala Agricultural Experiment Stations project.

The GGDP integrated into CRI and working together with the Ghana Legume Development Board (GLDB) and extension services of the Ministry of Agriculture is perhaps one of the most cost effective grains research extension project in all of sub-Sahara Africa.<sup>16</sup> The project focussing on maize and cowpea has its own management board with the CRI Director as chairman and representatives from the Ministry of Agriculture, university-faculties and farmers' organizations. It is funded almost entirely by CIDA. CIMMYT, as the executing agency for CIDA has two resident scientists along with one resident scientist from IITA working on cowpeas and soybeans.

The project has the largest concentration of Ghanaian scientists within CRI at Kumasi, 14 out of 29, 12 of them working on maize and two on grain-legumes. On farm verifications and trials are carried out with the help of the GLDB and the extension services of the MOA. The GLDB produces seeds of the recommended variety and conducts adaptive research. 220 out of a total staff of 520 at the GLDB are assigned to the GGDP. The project is now paying off with better yields per unit area, reasonable adoption by small farmers of improved seeds as well as agronomic practices. More investigations on varietal improvement for meeting consumers preference, better storage capability and disease resistance continue along with farmer managed trials, while renewed emphasis is being given to problems regarding sustainable cropping system in the low land tropics such as soil degradation and erosion. An early maturing cowpea variety suitable for intercropping with grains or for relay cropping is also being widely adopted by the farmers. Breeding efforts and on-farm trials go hand in hand, rather than the latter being subservient to the former. In fact the breeding program is informed and refined by the indigenous production system instead of disturbing it.<sup>17</sup>

Similarly, the Nyankapala Project, focussing on farming systems, crop rotation, intercropping and alley cropping trials, and also on sorghum, millet, rice, groundnut, soybeans and legumes is integrated into the CRI and supported by GTZ. There are 8 Ghanaian scientists on the station and six (6) graduate national service personnel, nine (9) technical officers and 476 junior staff. The ten (10) expatriate scientists include two from IRAT. The project, has had its own steering committee and government budget since 1983, but continues to be part of the CRI activities and the Director of the CRI is the chairman of the steering committee.

Nevertheless, "Food crop research supported by external agencies in Ghana is productive, well-organized, well managed and adequately financed. They are linked to the IARCs, provide training for local staff, have mobility, are in contact with farmers and with the extension service and have a high profile. In contrast, food crop research at CRI not externally supported such as root

<sup>16</sup>/Eric Tollens Report on Ghana, April 88. (CGIAR Task Force Report)

<sup>17</sup>/Dr. Baffour Badu-Apraku the CRI co-ordinator of GGDP, Dr. Hussain, resident scientist of IITA at Kumasi and Mr. W.S. Abutiare from the CRI are authors' sources for the above summary of the GGDP.

and tuber improvement suffers from a lack of funds for research, has no transport facilities, is poorly linked to farmers and to the extension service, is poorly connected to the IARCs and is finally not as productive."<sup>18</sup> CRI has not been able to publish its Annual Report for several years because of a shortage of funds. Similarly, a complete inventory of indigenous herbal species of Ghana is locked up in manuscript at the C.S.R.I. Mr. W.S. Abutiati, Principal Research Officer at the CRI, told the authors partly in jest, that the almost impossible road access between Kumasi and the CRI headquarters reflect the anguish, the immobility and the mental isolation of many Ghanaian scientists. The physical facilities for the CRI which have been under development for the last twenty years at Fumesua, are still incomplete.

### RESEARCH IN THE UNIVERSITIES

The research facilities for crop, legumes, oilseeds, tree crop and animal research with elaborate stations in the Savannah, coastal, transitional and forest zones of universities at Legone and Kumasi have been starved of minimal financial support for more than a decade. At Legone, the green house is in a state of disrepair. There is no growth chamber or tissue culture facilities, and there is limited mobility and marginal laboratory acquisitions. A tissue culture laboratory is being set up under the IFAD project for roots and tubers. As Professor Akeyempong, the Pro-Vice Chancellor of the University of Ghana told the authors, the University lost a sizable number of senior scientists in the early 'eighties and the critical mass is yet to be built up. Also, the high cost of living and low compensation, inspite of some recent increase in monthly salary, do not allow for survival for more than two weeks in a month. Many junior and even senior scientists have had to do two jobs. The rather large facility for an animal research station, including 700 hectares of pasture and forage land, suffer from lack of on-station scientists as well as marginal and ad-hoc funding. Of the four on-station scientists, one is on study leave, and one, has yet to assume duties.

Except for animal traction research supported by German volunteers and funding, most other research operations barely subsist, through the informal acquisition of breeding stocks from the Ministry of Agriculture for example, and through external support such as the FAO project on cattle feed.<sup>19</sup> The story repeats itself in the university at Kumasi. Except for the GTZ assisted program with the department of agricultural engineering, other research operations are starved of resources. There is only one land rover available for crops research and extension, after it has finished running all the errands for the department. However, since research achievement is a necessary criterion for promotion, faculty members, sometimes, piggy-back their research on the dissertation of graduate students. Otherwise faculty

<sup>18</sup>/Eric Tollens, op. cit.

<sup>19</sup>/Professor Williams, head of the Animal Research Station hitched a ride with authors from the Dean's office to the station. His personal relationship with his ex-student, the Deputy Minister in M.O.A., responsible for animal husbandry, has helped him off and on in getting ad-hoc support.

members obtain individual contracts mostly from outside. A professor in crop sciences at Kumasi is working on banana with support from INIBAP (International Institute for Banana and Plantains).

## VIEWS OF MINISTER STEVE OBIMPEH

It is in the above perspective that the authors would like to recount what Minister Steve Obimpeh told them about the current initiatives to ensure the implementation of the new agricultural and conservation policy during the second phase of the Economic Recovery Program. The CSIR, the main co-ordinating body for scientific research in Ghana has representatives from the MOA in the governing council as well as in the Technical Committee for Agricultural Research (ICAR). However, the research institutes defend their research plan with the Ministry of Finance and Economic Planning. Neither the CSIR nor the MOA has been associated with budgetary matters for the CRI since it was established. The Ministry has established an Agricultural Development and Advisory Committee. But, today, the major instrument for agricultural research development co-ordination is the Agricultural Policy Co-ordination Committee under the chairmanship of Undersecretary for Finance with representatives from the Ministries of Transport, Trade, Land and Natural Resources, Roads and Highways, Local Government and from the Bank of Ghana and Cocobod. The problem is not just that of research co-ordination or of research/extension interface or of education research extension linkage. The problems are those faced by a majority of small farmers (about 90%) who are poorly served if at all by access to credit, to inputs, and by a marketing infrastructure.

For example, there is little budgetary provision to ensure the mobility - indeed, survival -- of 5,000 extension agents, except in aided projects, while the import of fertilizer and the purchase of seed by the government is almost always constrained because both local funds and foreign currency are not available. As the official document on Agricultural Policy and Strategies (1989-1993) notes, the fertilizer for 1988 is still to be received while the Ghana Seed Company cannot mobilize funds for the purchase of seed in the coming season.

The minister, while appreciative of the World Bank Agriculture Sector Rehabilitation Program, stated quite emphatically that the credit and marketing problems of small farmers had to be reckoned with in real terms rather than in ideological perspectives. The high cost of transportation and infrastructural problem constraining the potential growth in Northern Ghana may, in the extreme, lead to a moratorium in research expenditure in favor of investment in transportation and marketing infrastructure. On the other hand, agricultural credit from the Bank of Ghana or agricultural development banks so far has served large scale farmers who can guarantee their loans. Focus on the 90% of small farmers would require a different credit policy with perhaps crop collateral and an amendment to the blanket prescription of the withdrawal of subsidy from inputs like fertilizer. Specifically the Bank of Ghana is

being asked to develop a more workable Credit Guarantee Scheme for rural banks involved in extending credit to small farmers as well as in mobilizing small savings. Again, the farmers' ability to repay depends on easy access to markets and reasonable price support.

The minister referred to the successful experience of the Global 2000 project which bring all the elements of the farmers' own experimentation, improved practices, inputs and if necessary, on-farm storage and marketing intervention together.<sup>20</sup> The basic assumption is that currently available technology and locally improved variety can result in major improvement in yield, if the farmers test the technology themselves rather than being confronted with demonstration by knowledgeable outsiders. The top down technology diffusion hypothesis ignores the fact that the farmers' view of a package of technologies and technology management practices may be quite different from technology generating systems. Some parts will appear attractive, some they will reject. Again, what a farmer may see is not a package or a discrete item but rather a solicitation to make a demand on time, land and labor. A farmer does not adopt. She/he adapts incorporating and modifying something with fuller compatibility to her/his situation. Global 2000 therefore, relies on farmers doing the testing themselves on their own plots, rather than on demonstration/verification by outsiders. Initially starting with 20 farmers in 1986, Global 2000 is now involved with 1300 farmers, and more than double the numbers of neighboring farmers following suit, in growing locally improved varieties of sorghum and maize. The extension agents of the Ministry of Agriculture, provided with mobility, supplies simple technical messages including timely delivery of fertilizer and easy access to credit. The farmers do their own trials and selective experimentation. The result has been a five fold increase in the yield of sorghum in the Upper West region.

There are other successful experiences in adaptive research and increase in small farmers' productivity like the maize improvement program of the GGDP. The minister feels that the replication of such experiences together with proper back-up of inputs, credit, feeder roads and on farm storage will enable continuing the momentum for increased productivity by small farmers. The World Bank projects for adaptive research and extension are, no doubt, valuable. But to amalgamate, for example, cocoa extension with an uniform multi-crop extension service including animal husbandry, may be difficult. The compensations and facilities of the cocoa board extension agents are quite different from those of the extension people under the Ministry of Agriculture. Besides, cocoa-farmers receive highly subsidized cutlasses, seed, insecticides, and sprayers which is not true for food crop farmers. More importantly, the linkage of research extension marketing should not be disturbed, now that the streamlining in the Board, and proper pricing intervention for cocoa farmers have resulted in a spectacular upswing in

<sup>20/</sup> Dr. Chong woon Hong, an erstwhile ICRISAT soil scientist, and now working with the Global 2000, briefed the authors on the project.

production.<sup>21</sup> The heterogeneity of production systems in Ghana, the individual use but communal ownership of land, the strong group and community support obligation system and the current dynamics of decentralization such as district governments, are realities to be reckoned with before the imposition of any uniform or preferred model.

## SUMMARY CONCLUSIONS

In summary, Ghana has a more than adequate human resources base, inspite of attrition and some critical gaps, for technology development with spill over potential for coastal West Africa. The problem is the lack of core funding for research programs which are not supported by external donors. The university system, though not formally linked with national research institutions, except through the sharing of committee chairs of various institutions, projects or technical committees, has excellent informal operational interface with governmental research and development. Formal co-ordination of research and education is no doubt necessary for a concerted national effort. What is more important, is modest but consistent budgetary support for systematic upgrading of existing facilities and skills including filling in some critical gaps. Again, the much publicized dichotomy between research and extension gets exacerbated when Agricultural Development and Extension Programs (ADEPS) are set up independent of the national research institutions or administrative mechanisms. The political support for sustainability of the National Research System does come about, even under extremely difficult economic circumstances, when its impact on development become obvious as in the case of the Global 2000.

As Lipton rightly points out some sorts of crops and animal research seem to respond to research. Concentration of scientists on these research issues would not only help to reduce the current dispersion, by increasing the critical mass applied to fewer issues, but will also bolster the political support and national core funding for the National Agricultural Research System. In other words, research content is more important than the form. Further, the neat distinction between upstream and downstream research hurts the sensitivity of African scientists and may make it difficult for them to obtain the pay-off from the biotechnical advances of the private sector in the north because of patents, intellectual property rights and high cost. The new International Centre at Adiopodume (IIRSDA)<sup>22</sup> concentrating on bio-technology, molecular genetics in African rice, yam genetics and molecu'ar biology

<sup>21/</sup> Chief Executive of the Cocoa Board is frankly skeptical of the initiative. So are Dr. Semi and Mr. Haruna Maamah in the Ministry of Finance and Planning.

<sup>22/</sup>The new International Centre is evolving on the erstwhile ORSTOM facilities of 230 hectares with laboratories for soil science, chemistry, molecular biology, plant pathology, virology, nematology, weed science, bio-technology and biological control of pests. While IITA is working in the humid and sub humid tropics and ICRISAT, in the Sahel, this new center can perhaps fill in the gap for the forest zone.

regarding the cassava virus may help in redirecting attention to the continuum of research, -basic, applied and adaptive-, rather than emphasizing the precept that some scientists are more equal than others.

Dr. Thomas Odhiambo is perhaps right when he says that "Africa has been sold the idea that it can transfer technology from other parts of the world to solve its own problems. But it will not work and we've lost a quarter of a century because of this simplistic view. I believe that basic scientific research is what will bring Africa to a position where it can control its destiny."<sup>23</sup>

Not only that, in the West African context, research has to be decentralized within a country to highly localized agro-ecological and socio-economic environments. Whether farming systems research should be secondary to commodity research or not may be a matter of academic debate. What is important is to go back to the ecological approach of the colonial researchers and agricultural officers in the 'forties. The comparative advantage of small farmers is precisely in maximizing use of local knowledge on diversity and broadening the food base through mixed or relay cropping of traditional crops or trees specific to their own environment. Cocoa farming by small farmers, for example, is well integrated into a food production system of plantains, banana and taro or other tubers, to provide food security without major labor bottleneck or sustained inputs. Decentralization has its cost and the problem of dispersion of the critical mass has to be reckoned with. But, as Lipton suggests "an obvious idea is to create microcosms of ICRISAT, i.e., national stations located at the borders of two or more agro climatic zones". Again, the experience of the colonial times where a small number of scientists were consistently but modestly supported over a long time horizon, may be recalled. Indeed, the issue of critical mass is unlikely to respond to neat general blue-prints applied by visiting or resident experts.<sup>24</sup>

Moreover, in the above context of ecological diversity, fragile soil, erratic rain fall and the potential of micro irrigation in West Africa, much problem solving research and factor research such as soil water inter-action, will be required. Universities with their disciplinary orientation can best complement the national/zonal institutions, conducting on farm and commodity research, in this task. This would mean building up some of the universities as regional/sub-regional centers, with necessary support like twinning arrangements with universities in the developed countries.

Similarly, regionalization cannot and should not be externally generated. Some national systems of both research and education can and do evolve into regional hubs or sometimes the countries may decide to combine their efforts when such a process is compatible with their national interests. It is important to nurture the process by supporting and strengthening national

<sup>23</sup>/Smithsonian, August 1988

<sup>24</sup>/Lipton, op. cit.

systems rather than imposing an institution without national roots or regional consensus.

Finally, resource constraints of national research efforts both for investment and operation, have to be faced squarely. In the absence of a prospect for continued, albeit modest financial support, consideration may be given to a mechanism for bridge funding so that research productivity is not jeopardized by interrupted financing. When faced with a need for long term research support to the International Centers, the donor community developed the CGIAR for core funding to the centers. SPAAR has been organized by the donors to co-ordinate donor support for strengthening national research and education system in Africa. Perhaps it is possible for SPAAR to have a modest bridge fund for working with African National Systems, when and where required, insulated both from the political imperatives of the donor, and the recurrent volatility of some African nation states.

## CAMEROON: (JANUARY 31 - FEBRUARY 5)

"Cameroon" writes Carl K. Eicher "is an underreported agricultural success story". If investment in agricultural research is a proxy for political commitment to technology production and adaptation such support has been very high indeed in the first half of the eighties. The budget for scientific and technical research quadrupled between 1974 (FCFA 1 billion) and 1980-81 (FCFA 4.7 billion). The present scenario is quite different. Ambitious plan of the government in the early eighties has resulted in expansion of research infrastructure in diverse agro-ecological zones and in impressive build-up of scientific and technical man power. The sharp decrease in governmental revenue since 1985-86 due to declining oil and cash crop prices has resulted in stagnation and in fact sometimes severe cut backs in research funding since 1986-87. Wages and salaries of permanent staff in IRA (Institute of Agronomic Research) earlier was around 60% of total operating funds excluding equipment purchase. In the crisis year of 1986-1987, the ratio rose to 85%. The estimated expenditure in salaries and wages for the IRA was 2.2 billion FCFA in 1988. IRA received 1.7 billion causing postponement and delay in such payment. According to Dr. Emmanuel D. Tebong, Director IRZ (Institute of Animal Research) there was a provision for FCFA 250 millions for research costs and equipment last year. But the fund was not released. This year a similar situation persists. Dr. Tebong and his colleagues are apprehensive of the probable loss in livestock genetic resources built up over a decade of hard work due to lack of funding for feed and drugs.

The uncertainty concerning the duration of belt tightening in government expenditure has damaged morale and work efficiency of the researchers and caused numerous research operations to be postponed or scrapped. Mr. Simon Mokoko Gobina, Plant Pathologist for rubber at the Ekona Research Center captures the mood of some scientists most poignantly when he says, "when you know how much you can contribute and when years are lost you feel frustrated and angry and apathy sets in". According to Mr. Kham T. Pham, ISNAR management consultant in the IRA, about two thirds of the more than four hundred research operations have been suspended in the IRA in the current year. The strains on some of IRA's major programs and thrusts are partially relieved by external funding of the recurring cost by the USAID, France (CIRAD/ORSTOM/CCCE), and by funding from parastatals and development organizations like Cameroon Development Corporation, SODECAO (Parastatal for cocoa), ONCPB (National Produce Marketing Board) and SODECOTON (parastatal for cotton) etc. or from private companies like Sandoz and CIBA-Geigy for rubber and semi-private companies for banana.

Where external funding is predicated on prefinancing by the government for donor reimbursement, the disbursement has been minimal. Government does not have the revenue for prefinancing, as in the case of World Bank's National Research Project. IRA requires about FCFA 10 million to cover the recurring cost in travel, fuel, per diem etc. for two months. Dr. Ayuk-takem, Director IER is negotiating with the World Bank as also with the Cameroonian Ministry of Finance for having a special cash account or imprest fund of that order to keep the important operations running in dispersed centers/stations and off-station. In case of animal-research where more than ninety percent of the resources comes from the national budget, the crisis is even more severe.

The problem is not the absence of suitable political environment for science and research. Both the fifth and the sixth plans of the government give priority to increasing agricultural productivity through emphasis on agricultural research and effective research development linkage. The problems are resource constraints, a general squeeze on public expenditure for structural adjustment and competing demands for the available resources.

It is against this general backdrop that we summarize the perceptions of national research and training needs and opportunities, current constraints and visible paths ahead as articulated by Cameroonian ministers and policy-planners, research-leaders and development practitioners, scientists and educators.

## EVOLUTION OF RESEARCH IN CAMEROON<sup>25</sup>

Agricultural Research in Cameroon has a comparatively strong tradition in West and Central Africa.

### AGRONOMIC RESEARCH:

From the late thirties up to the mid sixties agronomic research was mainly focussed on export crops like cocoa, coffee, oil-palm, rubber, banana etc. Cameroon Development Corporation, for example, initiated research at

<sup>25/</sup> Authors are indebted to the Honorable M. Abdoulaye Babale, Minister for Higher Education, Computer Services and Scientific Research, the Honorable M. Ha Madjoda Adjouda, Minister for Animal Production and Industries, Messrs. J. Jean Nya Ngatchou, Inspector General of Research, and M. Ronald Wandji, Director of Research, Dr. Ayuk Takem, Director IRA and Dr. Emmanuel Doh Tebong Director IRZ, and their colleagues for their frank and incisive discussions and patience.

Ekona on banana, cocoa and oil-palm with emphasis on breeding agronomy and plant protection. By 1967, with assistance from French research institutes research activities intensified on the tree-crops including tea, coffee and cocoa. PAMOL Cameroon Ltd. had also their own research units at Lobe in the Southwest province.

From 1965 to 1974 several French research Institutes conducted agronomic research for Cameroon. Some of these were:

- a) IRAT for food crops,
- b) IRHO for oil palm,
- c) IRCA for rubber,
- d) CTFT for forestry research,
- e) IRCT for cotton,
- f) IRFA for fruit trees research,
- g) IRCC for cocoa and coffee research, and
- h) IEMVT for animal research, etc.

The Government of Cameroon created the National Office for Scientific and Technical Research (ONAREST) in 1974 to take care of all research in Cameroon. It then regrouped some of the former French Research Institutes to form its own research institutes.

All the functions of ONAREST were later on taken over by the General Delegation for Scientific and Technical Research (DGRST) in 1979. DGRST was succeeded by the Ministry of Higher Education and Scientific Research (MESRES) in 1984.

MESRES, now called, MESIRES (Ministry of Higher Education, Computer Services and Scientific Research) has five research institutions, namely:

- Institute of Agronomic Research (IRA),
- Institute of Zootechnical Research (IRZ),
- Institute of Human Sciences (ISH),
- Institute of Geological and Mineral Research (IRGM),
- Institute of Medicinal Plants and Medical Research (IMPM).

The Institute of Agronomic Research (IRA) is the largest of the five research institutes. It has 2,400 workers among whom there are about 190 scientists consisting of 130 nationals and 60 expatriate staff. According to the Director IRA 40% of the scientists are well-trained while the technician scientist ratio is woefully inadequate.

IRA has 6 research Centers, including soils and forestry, 16 research Stations and 29 Sub-Stations which are located throughout the agro-ecological zones of Cameroon.

Presently, IRA has sixteen research programs which are grouped into two priorities, namely:

### PRIORITY NUMBER 1

These are research programs which are focussed towards making Cameroon achieve food self-sufficiency. Some of the research programs in this category are:

- Cereals (maize, rice, sorghum and millets, wheat, etc.),
- Root and tuber crops (cocoyams, cassava, yams, etc.),
- Grain Legumes (cowpeas, beans, groundnuts, soybeans, etc.),
- Vegetable crops,
- Bananas and Plantains,
- Fruit and pineapples,
- Food Technology,
- Farming Systems Research,
- Conservation of Genetic Resources,
- Pedology.

### PRIORITY NUMBER 2

- Stimulant Plants (cocoa, coffee, etc.),
- Oil crops (oil palms, cocoanuts, etc.),
- Rubber,
- Textile crops (cotton),
- Forestry research,
- Botanical research.

A major criterion for such prioritization, according to Dr. Ayuk-Takem, is that of stable and continued availability of funding for research.

Sustained funding is available for cocoa or cotton research for example from export tax or cess as opposed to the programs in priority I, so precariously dependent on external support.

### ANIMAL SCIENCES RESEARCH

IRZ has two centers, Wakwa center which covers Adamaoua, North and extreme North provinces being historically linked to the French institute

IEMVT since 1934, and one in Western and North-west provinces, Bambui established in 1954. There are two and four stations and one and two antennas respectively for the centers based on agro-ecological zones. For oceanography and fisheries there are stations in Kirbi and Limbe with a station in Fouban for inland fisheries and aquaculture. A new station for the forest zone has been opened up in Bertoua. IRZ with a total staff complement of around 1000, has 90 scientists, all of them M.Sc.s or equivalent and some Ph.ds and 160 technicians, the vast majority being B.Sc.s or equivalents. The problem is not the specialization of the scientists in IRZ, nor the ratio of technicians to researchers. The scientists who have mostly been recruited and trained in the early eighties lack experience. Further, with the lack of wherewithal, the young scientists are idle and may take off for weeks from their stations or sub-stations. It is difficult to maintain discipline.

Both in IRA and IRZ the researchers have a special statute which makes provision for allowances and can be almost as much as the salary itself thereby doubling the income. For the technicians there is no special statute. The resultant apathy among the technicians is quite obvious both in IRZ and IRA. Minister Abdoulaye Babale told the authors quite candidly that, although on the agenda, nothing can be done about special allowance for technicians or for the administrative support staff in research institutes till a macro agreement is reached with IMF and World Bank vis-a-vis the structural adjustment program.

Research by IRZ is conducted in eleven programs: beef, dairy, small ruminants, pigs, poultry and rabbits, pasture management, fisheries, veterinary science, Equine and Wildlife. But most of the programs are in suspended animation due to lack of operational fund. There is inadequate water supply in Wakwa center and no telephone connection with Bambui. There is a specialized laboratory for dairy technology in Bambui, elaborate infrastructure for veterinary research and virology laboratory at Wakwa, and perhaps one of the best laboratories for animal nutrition in the continent at Mankon, all underutilized. Dr. Tebong recognizes the high running cost of multiple infra-structure. But as he says, "there is no choice because of the agro-ecological diversity. The advantage is in problem solving for the farmers. They come and see the work that we are doing in antennas, stations and centers and the multiplier effects within the zone is phenomenal. If we have to close some of the them down, the consequences for research development linkage will be serious." IRZ has worked with parastatals like SODEPA, but emphasis on revenue earning research may sometimes divert resources away from the priority research thrusts. In view of the ongoing economic crisis a proper balance has to be worked out.

### RESEARCH IN OTHER INSTITUTES AND UNIVERSITIES:

Agro-economic and sociological research are carried out in the Center for Economic and Demographic Research in ISH (Institute of Human Sciences). The University Center of Dschang has joint research projects both with IRA and

IRZ. IRA staff at Dschang research station supervises student theses. Similarly UCD cooperates with IRZ in drawing up research programs and operations. IRZ provides research facilities to the students of UCD as also to the students of the faculty of science, University of Yaounde. There is also strong linkage between the institutes of agronomic and animal research and the university center at Ngaoundere specializing in food technology. ORSTOM working within the national institutions has already published soil and land use atlas and environmental characterization for North and Extreme North Cameroon in collaboration with the National Soils Center, the University of Yaounde and the IRGM. A more difficult work on soil classification in the forest zone with the help of radar and remote sensing is in progress. Beside research on soil water management for rehabilitation of marginal lands in the north is an inter institute program.

Production systems and distribution of traditional food crops or genetic evaluation and nutrition potential of crops like cowpeas; interdisciplinary inventory of natural resources are some of the programs where various institutes like ISH, IMPM (Institute of Medical Plant and Medicine), National Soils Center and Forestry Center of IRA, work together. They receive scientific support from the ORSTOM and financial support from France and the EEC. Further the University Center at Dschang is mandated for review of national research programs and system. In fact a team of four professors have recently conducted an analysis of research programs and prepared an interim report on rationalization of research stations/substations in Cameroon. The report could not yet be printed for lack of fund. Recently USAID has agreed to pick up the tab. This report will serve as the background paper for restructuring Cameroonian research system and programs.<sup>26</sup>

## PROGRAMS THAT WORK/RESEARCH DEVELOPMENT INTERFACE

Export crops like cocoa and coffee are examples of integrated research extension and marketing with the support of cess collected by ONCPB. IRA has conventions or agreements with regional development organizations like UCCAO, (Central Union of Agricultural Cooperatives of the West) for mainly coffee as well as for other crops. Supported by both scientific and financial resources from France coffee research and development are well in hand. SODECAO, the parastatal for cocoa supports cocoa research and the research is demand driven. Rubber and oil palm research is supported by industrial plantations like CDC or Hevecam (Hevas due Cameroon) or SOCAPALM (the parastatal for oil-palm) and by private companies including the multinationals. Cotton research extension and marketing is marked by a vertically integrated "filiere "

<sup>26</sup>/Messrs. Kham T. Pham of ISNAR, Jay P. Johnson, Director USAID Cameroon, Mr. E.M. Edmundson of USAID and Mr. Zelig Matmor of World Bank informed the authors of this review and the problem of funding for its publication.

approach by SODECOTON with strong management support from the parent French company CFDT which also acts as a conduit between the donors and the Cameroonian parastatal. Since cotton is grown in poor regions, it has become an important instrument of government's income distribution and regional development goals. As Uma Lele<sup>27</sup> notes, "SODECOTON undertakes some applied cotton research on behalf of the Institute for Agronomic Research (IRA), and supports an extension force of about 650, reaching about 140,000 farmers. It is also the major source of rural credit in the northern provinces of Cameroon and the provider of all agricultural inputs. In addition, it owns and operates the commercial ginneries and oil mills and has an important equity in CICAM, the country's sole textile factory. Perhaps most important, SODECOTON has taken an increasingly active role in promoting food crops; its extension agents have promoted maize, rice, and groundnut cultivation and have engaged in marketing activities. SODECOTON's activities in the food crop sector generated a total production worth CFAF 2 billion (approximately US\$5.8 million) in 1986/87 alone.

All these activities make SODECOTON the dominant rural development institution in North Cameroon. SODECOTON's activities generated CFAF 15 billion (approximately US\$43.3 million) in 1986/87 income for the region's rural population. Reflecting this importance, it has had a role in the implementation of all the major rural development projects financed by international donors".

In food crops, the National Cereals Research and Extension Project is perhaps a remarkable success story with both national and donor commitment over a long time frame and an innovative interface between research and the farmers. A program for maize, rice, sorghum and millet spanning over fifteen years supported with 43 million dollars from USAID and 27 million dollars from the Cameroonian government, and back stopped by 21 scientific personnel from the IITA (16 are in position to date) and more than double that number of counterpart national scientists is an impressive example of what committed partnership can do in national institution building. Beside varietal development in intermediate altitude maize and short-maturing second season low altitude maize, improvements in sorghum and millet and in irrigated and cold tolerant rice, the project has initiated a rather novel interaction between research and the farmers through on farm research by Testing and Liaison Units (TLU)

In principle, there exists one TLU per agricultural area. Actually, four are in operation, one in Bambui for the highlands, one in EKONA for the littoral-volcanic area, one in N'KOLBISSON for the lowland forest area and one at MAROUA for cereals, legumes and farming systems research in the North, and one is planned in the near future at FOUMBOT. The TLUs depend on IRA for an agronomist breeder, an agro economist, and a sociologist. The extension

<sup>27</sup>/MADIA: Cotton in Africa: An Analysis of Differences In Performance by Uma Lele, Nicolas van de Walle and Mathurin Gbelibou, January 1989.

officer is seconded by the Ministry of Agriculture. Originally, they covered only cereal crops but they have now been extended to root and tuber crops and other food crops technology is available. IRA has an agreement with the Dschang University Center for the elaboration of extension bulletins on root and tuber crops by university staff and this will be extended to other crops in the future.

Multiplication and diffusion of improved varieties of maize and cassava is taken up by MIDENO (North West Development Authority), SODECAO, SODECOTON, UCCAO, and CDC (Cameroon Development corporation). MIDENO produces certified seed and they carry out training and visit extension. For this purpose, they have established 9 trial and demonstration centers (TDC) and this is done in close collaboration with the TLU. Several of the TLU-BAMBUI on-farm trials are carried out by TDC's from MIDENO. In MIDENO, there is now one extension worker per 400 farmers. 9 rural development centers (RDC's) and 64 farm service centers (FSC's) are being established to supply inputs such as seeds, fertilizers and pesticides to farmers.

Although the MIDENO experience is unique in Cameroon, there are plans to establish Development Authorities along the MIDENO model in other provinces. MIDEVIV (Mission du Development Vivriere) supported by USAID also multiplies seeds of improved varieties at Sangueré and other locations.<sup>28</sup>

There are other linkages, for example for irrigated rice with development agencies like SODERIM (Society for the Development of Rice in Mbo Plain), UNVDA (Upper Nun Valley Development Authority) and most importantly SEMRY (Society for the expansion and Modernization of Rice in Yagoua) which is supported by French financing and accounts for 70% of the rice produced in Cameroon.

SODECOTON is a primary mover of agricultural technology in the northern region of Cameroon. This parastatal organization works directly with NCRE researchers in identifying research needs, collaborating in research trial, and evaluating research results. NCRE researchers and, more broadly, IRA scientists serve as part of the research arm of SODECOTON, whose mandate for rural development includes cereals production. IRA and SODECOTON interface through a specific written protocol agreement that elaborates how the joint research will be conducted. Annual meetings between IRA researchers and SODECOTON scientists and administrators establish research targets, including those specific to cereals research.

<sup>28/</sup> Authors are indebted to Dr. Emmanuel A. Atayi, Chief of Party for NCRE for the above. Also, Messrs. Peter Profvelt and Eric Tollens: Report on the Republic of Cameroon for the CGIAR Task Force on Sub-Saharan Africa, mimeographed, April, 1988. The Honorable Tikela Kemone, Secretary of State for Agriculture provided the explanation for the interface between research and rural development agencies.

Another long term project which reinforces the Cameroon Root Crop Improvement Program (CNRICP) established in 1978 and supported earlier by Belgium and IDRC Canada, is the Tropical Roots and Tuber Research project (ROTREP) funded by USAID and implemented collaboratively by IRA, University of Maryland Eastern Shores, Alabama A and M University and Florida A and M University. The on-station research activities of ROTREP are concentrated at Ekona and Njombe. The on farm research activities will cover the Northwest, Western, Southwest and Littoral provinces of Cameroon. The objectives are to develop acceptable variety of cocoyam resistant to root rot and blight complex; develop seed stock multiplication systems for cocoyam, yam and cassava; assess post harvest problems and opportunities for improving storage and processing; and assist in institutional development (human and physical) of the IAR in root and tuber crops research. A tissue culture laboratory and three tier green houses have been set up and equipped. Professor Joseph Woutoh, and tissue culturist Dr. Simon Zok suggest that the Ekona laboratory is the only one working on cocoyam in West and Central Africa. There are three long-term US scientists with eight Cameroonian counterparts in the project with flexibility of short term consultants built in.<sup>29</sup>

The NCRE and the ROTREP are long term projects with emphasis on institution building particularly the human resources through in service training, visiting fellowships to international centers, and specialized training at M.Sc. and Ph.d level. This is in contrast to the National Research Project where the human resources development component comprises less than 10% of the project cost and no expenditure on training has been made so far. Incidentally the CRSP projects in cowpeas and bean are well integrated into the national system and with the Dschang University Center research projects.

Another innovative research program is the diversification of crop production in the North with livestock improvement and introduction of fruit trees (citrus, mango etc) in collaboration with SODECOTON. The project funded by CCCE and the French Ministry of Cooperation and scientifically supported by CIRAD and ORSTOM has helped build up the Garoua station and bring together scientists from the IRA, the IRZ and the Forestry Centers. Beside soil water management for the farming system encompassing tree annual crop and live stock remains<sup>30</sup> a basic area of applied research.

Documentation and information exchange among national institutions universities and relevant external research institutions is an important instrument for cross fertilization of experiences and research results.

<sup>29</sup>/The above is a distillation of what Dr. Emmanuel T. Acquah told the authors at Ekona.

<sup>30</sup>/ The above is a summary of discussions with Messrs. Philippe Mathieu, Representative of ORSTOM, Jean Louis Messager, Director of CIRAD in Cameroon and M. Matres of Caisse Central de Co-operation Economique (CCCE).

ORSTOM is setting up a computerized data bank for research results and documentation for the Ministry of Higher Education, Computer Services and Scientific Research. Data available in the Dschang University Center, the University Center of Ngaoundere and documentation of other Cameroonian institutions like IFORD (Institut de Formation en Demographic) will be collated, for example, along with data generated by ORSTOM/CIRAD.

### REGIONAL/TRANSNATIONAL COOPERATION AND NETWORKS:

Cameroon is the lead-country and coordinator of maize network of CORAF (Conference of African and French Agricultural Research Leaders) comprising 15 francophone countries. Roughly 50% of the researchers in the CORAF maize network operate in Cameroon. Rather than confining research collaboration to general themes of germplasm and information exchange and multilocational trials, CORAF network also embarks on applied research in projects of common interest. Research responsibility is dispersed among collaborating national programs each developing components of a technology required by other members of the network with a lead NARS as the central base having comparative advantage for the subject. Congo for example coordinates the CORAF cassava network using the tissue culture laboratory in Congo for a project on the genetic improvement of cultivars while the Institute for Tubers in Togo is undertaking a project of agronomic evaluation of the national varieties and cultivars. Similarly ISRA in Senegal is the central base for CORAF groundnut network.

Two attractive features of the CORAF networking are first that the sensitive division of labor in research allocating adaptive research only to NARS is done away with integrating all aspects of research; and second, research priorities and proposals are decided upon in working seminars with attendance of national correspondents of the collaborating countries and research responsibilities are shared by different national research teams. The second mechanism promotes regional solidarity. The participants feel that the research they are doing is part of their own program and not just part of an imposed trial.

However that may be, too many networks can create confusion and put excessive many demands on the national system. Cameroon being bilingual participates both in the CORAF and the IITA networks (which includes anglophone countries of West Africa) for maize and cassava. SAFGRAD has also its regional program mainly adaptive in the semi arid zone. Harmonization of the network activities is essential. In fact Dr. Ambey, chief of root crops at Ekona has voiced this concern regard the two cassava networks. Fortunately in late June of 1988 a harmonization meeting took place at Ibadan among IITA, CORAF and SAFGRAD.

There are other regional programs. CIP for example has established its regional center for West and Central Africa in March, 1988. CIP however is a

unique international center in that it works with national programs to understand their priorities and target groups and to better meet their needs, thus avoiding all vestiges of patron client relations.

ICRAF has its agro forestry program in the humid low lands in Cameroon for hedge grow intercropping management system, improved fallow management trials on farmers' land and multi purpose tree (MTP) survey covering the Lekie and Djaet Lobo departments. The program though integrated with agronomic research has very tenuous linkage with the Center for forest research within IRA. The foresters, working on natural forest management and botanical program have not yet adopted agro-forestry as a valid research theme.<sup>31</sup>

Interface between ILCA and IRZ is very positive particularly in on-station trials for alley cropping and for fodder banks. IRZ participates in African Research Network for Agricultural By-products (ARNAB). Scientists of IRZ takes advantage of ILCA's training program both for short courses and for Ph.d research.

An exciting new regional initiative articulated by the CGIAR Task Force Report for Strengthening Maize and Cassava Research in Eleven Coastal West and Central African countries, is to utilize Institute of Agricultural Technology at Dschang University Center for training agricultural research technicians in the West and Central African region. As a bilingual center, the Dschang University Center already draws a sizable number of students from other African countries.

#### **PROBLEMS AND OPPORTUNITIES: SUMMARY CONCLUSIONS:**

Clearly national funding for agricultural research in Cameroon is fragile, precarious and uncertain. Such an environment militates against systematic research programming process. Previously, the Board of Management of the research institutes chaired by the Minister for Research with representation from the Ministry of Finance and the Ministry of Economic Planning approved both the annual program and the required budget. For the last two years only the program is approved, the availability of resources being uncertain. Lack of operating funds seriously inhibit the conduct of research, particularly off-station work, with the exception of externally funded special projects where all operating costs are covered. The cereals research program is well funded and over a long period through the NCRE project. Cassava program on the other hand for which Belgian and IDRC funding has been discontinued since 1986 suffers from an acute lack of operating funds to pay casual labor, travel expenses, vehicles etc. National Research Program in Cameroon requires a marked increase in operating credits for a long-term

<sup>31</sup>/ Mr. N'sangou Mama, chief of CRF has very little interaction with ICRAF project.

stability. During the current period of economic crisis this credit including recurring costs has to be picked up by donors in a coordinated manner relating to nationally articulated priorities.

A bureaucratic problem for NARS in Cameroon is the lack of any special account or imprest fund and the various sanctions required for the release of fund from the directorate of Public Debt. Similar problem persists in procurement of equipments. Tax clearance, for example, is difficult to obtain even when there is prior agreement between external funding agency and national government.

On the other hand, freeze on recruitment causes critically adverse impact on some priority program. As an example, the country report on Cameroon for the CGIAR Task Force notes that "the only root crop researcher at Nkolbisson is responsible for cassava, sweet potatoes, cocoyams and yams for the East Central and Southern Province, he does part-time studies in the USA to obtain an Ph.d. degree, has very limited operating funds, no on-farm trials and very weak linkages with extension". Similarly at Ekona, the French plant physiologist for rubber has had no national counterpart for last so many years. Again, the ratio of technicians to researchers is woefully inadequate and the technicians suffer from low moral, as unlike in the case of researchers, there has been no special statue for topping up their emoluments.

Cameroonian efforts in promoting research and development jointly in the small holder context have succeeded in SODECOTON for example with a filiere approach integrating research, input-delivery, extension and marketing. Otherwise attempts at reaching the small holders through parastatals like FONADER and farmers' cooperatives have not succeeded. In fact in 1987 FONADER could not make any fertilizer available. Research on small farmers' access to credit and inputs is rather thin except on ideological questions of removal of subsidy and deregulation of fertilizer import for example. The rotating savings and credit groups in the informal sector, tontines and njangis play an important role in mobilization of rural saving and continue to remain underresearched.

There is also the marketing constraint. As the country report on Cameroon for the CGIAR notes: "The marketing of maize is very fragmented. Large buyers of maize, such as breweries of feed mills, have difficulties in finding sufficient quantities of good quality maize since there is a shortage of maize merchants dealing in large quantities. This explains why such companies usually resort to imports. As they are mostly located at Douala, it is easier to import large quantities in bulk at world market prices and have them delivered at the company from the port than assembling a large number of small quantities of different quality from various small scale traders, located usually far away outside the forest belt in the West, North West or Adamaoua. Moreover, local maize production is not competitive with imported maize in bulk at heavily subsidized world market prices." Again, policy

research on imports, whole sale marketing operations, the monitoring of maize marketing and the dissemination of market information seems to be in order.

For root crops, very little of the produce enters the marketing system. The problem of transportation between producer and consumer areas, post harvest technologies for processing and storage, the potential for expanding parallel market across the border are areas that need analysis for successful interface between research and development.

The marketing constraint becomes most obvious in case of irrigated rice where the technology exists and the farmer adoption rate is high. There is a stock of more than 90,000 metric tons of unsold rice in the SEMRY operation. At a government determined producer price for paddy for FCFA 78 per kg the price for SEMRY rice in Yaounde and Donala is about FCFA 270 as opposed to the market price of imported rice at FCFA 118. There is no alternative to rice production for a large number of small farmers in the extreme north and substantial investments have been made in irrigation. SEMRY's marketing problems need immediate resolution.

The above are some of the research agenda that are not being addressed.

As for regional programing, there are some imaginative initiatives where each of the member countries in a network assumes responsibility for the specific projects for which it has a comparative research advantage communicating its results to their member countries. Building up a regional or transnational initiative according to the requirements of the national system needs to be emphasized vis-a-vis client oriented supply driven program. Beside as an ISNAR document notes, "the networking approach seems to be more readily accepted by participating country/NARS if this is a way to establish additional funds and if most of these resources are used to strengthen their national program". But networks should supplement rather than substitute national systems. As Isaar Omari points out in Eastern and Southern Africa Network coordinators' Review (9-12 May 1988, Nairobi). "It is no use having an excellent network without the national infrastructure to relate to." Networks "can easily be conduits for maintaining, if not increasing, the already existing asymmetrical power relations between scientists from developed and those of developing countries.... With emphasis on local participation and a bottom-up approach, networks can be vital in our efforts to reach the rural communities rather than being passive observers in nests located in International Research Centers."

## KENYA: FEBRUARY 6 - 12, 1989

Dr. B. N. Majisu is the Director General of Kenya Agricultural Research Institute which is being reorganized under the National Agricultural Research Project since 1988. He has been the first African Director of East African Agricultural and Forestry Research Organization (EAAFRO) until 1978 and later, its successor, Kenya Agricultural Research Institute (KARI). The collapse of the East African Community (EAC) coincided with the setting up of National Council for Science and Technology in Kenya. The Science and Technology (Amendment) Act of 1979 provided legal blessing for the setting up of KARI (Kenya Agricultural Institute) amalgamating EAAFRO (East African Agriculture and Forestry Research Organization) and EAVRO (East African Veterinary Research Organization) sharing the same estate at Muguga. Unlike other research institutions, set up under the Act like KETRI (Kenya Trypanosomiasis Research Institute) or KEMFRI (Kenya Marine and Fisheries Research Institute) or KEMRI (Kenya Medical Research Institute) KARI was not integrated with around 46 national, regional research centers, sub-stations and trial sites for factor and disciplinary research and commodity research in crops and livestock. Scientific Research Department in the Ministry of Agriculture and Veterinary Research Department in the Ministry of Livestock Development respectively continued to be the locus of the national agricultural laboratories and research centers.

The new Kenya Agricultural Research Institute, set up in the late eighties as a semi-autonomous agency with a governing board, has consolidated the KARI at Muguga, the scientific Research Department of MOA and the Veterinary Research Department of MOLD. Presently rationalization of national centers and laboratories for technology generation in major crop-commodities and livestock as well as for factor-research in soil-water management, for example, and of regional centers for adaptive farming systems research in respective agro-ecological zones is in progress.

### CURRENT STATE OF TECHNOLOGY: SOME EXAMPLES

Maize is the most important food crop in Kenya grown by 90% of the farmers and occupies 60% of the cultivable land. The hybrid maize-technology saw a significant advance in the sixties with large-scale adoption in high-potential areas by smallholders who were allocated formerly settled European land, by the early seventies. Since then, there has been little intensification of maize production due to marginal progress in the adaptability of the technology in different agro-ecological zones, and intermediate altitudes, due to neglect of maize research, and of marginal access to credit and inputs by smallholders. Farmers with 5 acres of land (previously it was 15 acres) are eligible for credit. Use of fertilizers by

smallholders is extremely low in maize. As Uma Lele<sup>33</sup> points out, priority needs to be given to agro-economic research under different ecological conditions, which could then clearly delineate where fertilizer use pays and under what ecological as well as labor supply conditions. For instance, since yields in some of the districts in the Rift Valley and the Nyanza Provinces are 3 to 4 times higher than in Eastern Province and the Coast Province, this may mean that the current efforts to increase maize production should be confined to high potential areas until research results can improve production elsewhere. On the other hand, high rate of attrition of senior scientists working on maize in the sixties, has led to significant loss of institutional memory on maize research. An attempt is now being made to get some of the old researchers back so that the work done in the sixties can be quickly adapted to the less favorable agro-ecological zones. Moreover, maize in a mixed-cropping system remains underresearched. The absence of technical packages suitable to small farming systems for alternative crops, like sorghum and millet, in the semi-arid areas has led to widespread maize cultivation in marginal land with low productivity. Adoption of technology where it exists, as in wheat, is inhibited by lack of access to credit and inputs by the majority smallholders. These questions require systematic empirical investigation before relative priorities can be determined for sequencing development interventions in national research capability, improved input delivery system, access to credit and market, and improving extension messages for farming practice. Restructuring the marketing board, for example, as the buyer and seller of last resort for maize, is no doubt desirable. It will however be politically impossible for the national government to undertake, till sustained production over a reasonable period of time can be assured.

Research on sugar and cotton has been weak. World Bank's project on sugar cane development in South Nyanza included a research component. However, as often is true of turnkey projects, factory construction took precedence. Very little research and experimentation to evaluate the impact of various factors on cane production -- fertilizer use, cane variety, weed control, intercropping, tillage, cane maturity, planting and spacing -- was undertaken. Kibos, MOA's sugar research station, did not get strengthened. What was required was a national sugar research program that gave priority to research on sugar and adequately supported the research station.

Cotton research was performed earlier by the Cotton Lint and Seed Marketing Board (CLSMB) mainly with technical assistance and marginal support by national scientific manpower. Research component of a Government of Kenya and World Bank project on Cotton Processing and Marketing has been transferred to the reorganized KARI and project funds (up to Ksh 1-2 million) are being channelled there. Complex procedures for fund release continues to be a problem. National research capability, both at Mwea Tebere and Kibos research stations suffers from inadequate support and lack of experience of researchers. Director Majisu strongly feels that research needs of cotton and

33 Agricultural Development and Foreign Assistance: A Review of the World Bank's Experience in Kenya, 1963-1986; Uma Lele and L. Richard Meyers, December 17, 1986.

sugar may be better served by coordinating research, extension, processing and marketing as in the case of tea. The case of pyrethrum appears to be similar to that of tea and coffee where a small research unit can effectively function in integrated or close relationship with production, processing and marketing and export. Tea Research Foundation, for example, is inextricably linked with the industry. This has been a highly successful model of research support, which does not rely on government, and has important implications for other commercial commodities not only for research but for farmer training in improved techniques.

The research program of the Veterinary Research Department now integrated into KARI is well coordinated with that of the Veterinary Research Laboratories at Kabete and ILRAD, with appreciable inputs from ICIPE, (International Centre of Insect Physiology & Ecology) particularly on the ecology of tick vectors. The research work on East-coast fever and trypanosomiasis is coordinated by the effective, although informal Nairobi Cluster which includes along with national laboratories, and veterinary research department, KETRI, ILRAD and ICIPE, and has strong linkage with research groups in Utrecht and Edinburgh. There has been no major break in the continuity of veterinary and livestock development research both enjoying direct funding including local costs, and technical assistance from ODA, under special bilateral agreements.<sup>34</sup> There is now a reorientation of research priority and input into smallholder dairying in the highlands. Smallholder dairying with grade dairy cattle is one of the most successful developments in Kenya over the last three decades particularly with valuable research results for extension produced by Dairy Cattle Research Section at Naivasha, supported by funding from the World Bank.

Attrition of specialized and experienced manpower continues. According to Mr. van Helden, Agricultural Research Officer, EEC, National Range Research Center at Kiboko has lost 13 of its twenty scientists within the last two years. The institutional memory of twenty years of work of this center supported earlier by FAO and USAID and now by EEC is almost lost due to the absence of reports and documents. A prime task is to collate the past experiences as well as field investigation of existing rangeland practices. Beside, the work of KREMU (Kenya Rangeland Monitoring Unit) needs coordination with KARI's work at Kiboko or at Marsabit dealing with animal production and pasture management of nomadic pastoralists. Similar fragmentation exists in crop research. Irrigation Development Board does adaptive research in irrigated rice and cotton without integration into KARI.

Kenya has impressive laboratories for factor research. Kenya Soil Survey (KSS) is indeed a shining star. National Dryland Farming Research Center at Katamuni has a strong program on soil and water management with a holistic production-systems approach and researcher-farmer interaction. But irrigation and drainage research suffers from woefully inadequate manpower for engineering design, water-management or micro-irrigation planning. The government's emphasis upon bringing new land under cultivation through

<sup>34</sup>/ Discussions with Mr. Brian Grimwood, Natural Resources Adviser, ODA, Nairobi.

irrigation, 80% of the land area being arid or semi-arid, points to the need for building the national capacity through a team of researchers, engineers and technicians.

The above are by way of examples and stands in contrast to tea and coffee research where research and development are coordinated with credit, inputs, processing and marketing. There is no lack of continuity either, because of sustained funding. Better scheme of service with promotion based on scientific qualifications and research output in the two research foundations has resulted in comparative stability of research staff and high quality of research output based on the needs of smallholders as well as larger estates. There has been some qualitative deterioration in the recent past. Labor-constraint, however, is an inhibiting factor in further intensification by smallholder. Similar success is also witnessed in the development efforts of private companies like Kenya Cannery (pineapple), Kenya Breweries (barley, paw-paw), British American Tobacco Company (BAT), Hortiquip (French beans for export) or East African Industries (sunflower). Access to input is assured, and marketing is guaranteed at a remunerative price.

### REORGANIZATION OF KARI: THE PROBLEMS AND CONSTRAINTS

Ever since the formulation of National Agricultural Research Project, KARI has been plagued with instability in its administrative location. At the time of formulation of the National Agricultural Research Project, crops and livestock research was under one ministry, the Ministry of Agriculture and Livestock Development. Subsequently the Ministry of Livestock Development (MLD) was created. KARI continued in the Ministry of Agriculture (MOA). In the later part of 1987 or early 1988, KARI was transferred to the Ministry of Research, Science and Technology. In June 1988 or thereabouts it was reverted back to the MOA. More recently it has been moved back to the MRST. Somewhere along the way its chairman of the board of management was changed, and a new chairman, Mr. Arap Too head of Kenya Seed Company, appointed. The scheme of service for KARI's staff while approved by its board has still not been cleared by the government. As a result, there is uncertainty in the field since most of the research station personnel continue to retain their previous positions under their respective ministries.

There is also an urgent need to finalize arrangements for the transfer of facilities from the ministries to KARI. In Naivasha for example, the KARI is interested in keeping the upper farm but MLD is also interested in keeping the same place. At Muguga, the MOA and KARI should agree on where the plant quarantine service should belong, so that responsibility for its management is clear. Dr. Majisu is concerned that the delay in implementing the new scheme of service and in deciding what facilities or functions will be transferred to KARI have resulted in many of the staff transferring to other agencies, particularly to the universities which have just upgraded salaries. The director believes that the single most important factor which would get KARI

moving would be the approval of the new scheme of service and the allocation of the necessary funds for its implementation.<sup>35</sup>

Morale throughout the KARI system appears to have been undermined by the administrative shifts. Not only has there been no stable home of the institution but research staff have felt that their research activities were not a high priority in the system taking a subordinate position to political/bureaucratic maneuvers. Researchers often cite morale as the greatest problem for KARI.

According to Dr. Majisu, it does not really matter where KARI is located. In fact its location in the Ministry of Research, Science and Technology can help in lifting up agricultural research from its earlier subordinated position in the ministries of agriculture and livestock development. What is important is that the uncertain environment ends once for all, and that the Board of Management starts functioning autonomously as in the cases of KEMRI and the more recently set up Kenya Forest Research Institute, both of whom have given effect to better terms of service for the researchers. Ambiguities in functions and facilities between development ministries and KARI as cited in the case of Naivasha, must be resolved quickly.

The second most important problem of KARI is financial. The difficulties stem partly from the recent transfer of KARI to the MRST which has caused inordinate delays in funds reaching KARI. KARI's 1988-89 budget is listed under the MOA so funds have been released to that Ministry. Counterpart fund from PL480 allocated for research has not been released for seven months by the Ministry of Agriculture to the Ministry of Research for passing on to KARI. The problem is compounded by the fact that proceeds from external sources (grants, credits and loans) shown in the budget as revenue requires prefinancing by the government for reimbursement from the source. World Bank credit shown as revenue in the budget, for example, cannot be disbursed due to government's inability in prefinancing. KARI has therefore requested the unreleased development budget in the form of appropriation in aid which can be disbursed through direct payment procedure and will not require a local currency advance from the Government. This problem needs immediate resolution as otherwise the national research project will not take off. In fact very little research is now being conducted for difficulty of the national government in prefinancing as well as for the complex bureaucratic procedure of fund release.

Autonomy in agricultural research is a problem both for KARI as a whole and for individual research stations within KARI. There has been a continual reluctance in supervising ministries to grant autonomy for research activities. One reason may simply be inertia and the newness of the institution with the belief that support is needed in its infancy. A second

<sup>35</sup>/ The administrative shifts of KARI has come up in discussions with Messrs. Quisumbing of World Bank and USAID mission director, Mr. Steven Sinding.

may be a lack of confidence in KARI administrators to operate the institution efficiently. Third, since KARI is a large and important institution, officials may be reluctant to relinquish authority for bureaucratic or political reasons. Fourth, the Board of Management has not yet been able to exercise its autonomy because of instability.

Autonomy is needed on the station level as well as vis a vis KARI headquarters in Nairobi. Micro management of stations from Nairobi is confusing, undercuts authority and incentives at the stations, and leads to lengthy delays in research programs. One of the more constraining interventions in station operations has been till recently, the inaccessibility of funds for station directors. Funds for research stations used to be deposited in district treasuries and were disbursed only with the approval of District Commissioners.

According to Dr. Majisu the problem of disbursement of funds for outreach centers and stations has been resolved, now that the station directors operate their own bank account. However, the persistence of civil service culture, in some cases, result in rather slow utilization of the new fangled autonomy.

Severe shortage of operational fund pervades the system. Wages and salaries take up about 90% of the recurrent budget. Due to an employment oriented expansion of the system there are too many scientists and too little money to support them to engage in productive research. Programs which are supported by donors and which cover operating cost and provide cash advance, do work. But lack of facilities equipment and transport are serious handicaps. There is only one landrover, for example, in Kiboko with minimal budget for fuel. EEC is now picking up the expenditure for fuel and provides 20% cash advance to offset the inability of government for prefinancing.<sup>36</sup> The ratio between salary and operational cost in Coffee and Tea Research Foundations stands out in sharp contrast, that is 65:35.

Permanent Secretary, Mr. Arasa feels that beside generous donor involvement, a way out of the funding impasse is for the research institutes to generate revenue as in the case of vaccines in veterinary research for instance or of foundation seeds in case of crops. The revenue, so generated, instead of flowing to the national exchequer, may be reinvested in research. Similarly some revenue can be generated through advisory and consultancy services to agro-industries or large estates. Permanent Secretary also visualizes the creation of a National Research and Development Fund with contributions from the private sector by articulating clearly the payoff for research investments to private entrepreneur and companies. Again, the balance between revenue earning activities and sustained research is a matter of debate. Some researchers feel that such an approach may dissipate scarce resources for research.

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<sup>36</sup>/ Discussion with Mr. van Helden, Agriculture Research Officer, EEC, Nairobi.

The imbalance in research expenditure, is accentuated by the fact that only about 30% of more than 500 researchers today in Kenya have specialized or post-graduate training. The next few years in Kenyan agricultural research, according to Dr. Majisu, will be a period of drought since a sizable number of researchers will be abroad for graduate studies -- 72 scientists are already out and another 60 will be placed by September 1989. But building up national capability is essentially a question of strengthening the creation of a scientific elite. A human resource planning effort, with obvious emphasis on specialization and bridging the critical gaps, is necessary. The pipeline of talent will dry up if the status quo persists. A continuation of the current limping will demoralize a sizable pool of talented, motivated and quite unrewarded individuals.

### KARI AND THE UNIVERSITIES

The following is a summary of discussions with Professor D. M. Mukunya, Dean of the Faculty of Agriculture in the University of Nairobi and his colleagues, Dr. J. F. Keter, Chairman, Department of Soil Science; Professor R. W. Michieka, Chairman, Crop Science, Dr. D. K. A. Some, Chairman, Agricultural Engineering and Dr. W. Olouch-Kosura, Chairman, Agricultural Economics. As a background, there has been rapid expansion of Universities for training and research in agriculture in the eighties. The faculties of Veterinary Medicine (founded in 1956) and of Agriculture in 1970 in the University of Nairobi, have now been joined by Jomo Kenyatta University, Egerton University, previously a center of excellence for intermediate level diploma programs in agriculture and related disciplines, and Moi University of Eldoret established in 1984/85 with special emphasis on agro-forestry related training and research including on-station trials at Eldoret and Ramafi in the high potential highlands.

According to the Dean, the present enrollment of undergraduate students is around 850 while the present enrollment of post graduate of about 100 students will double by 1994 to 200. There are 14 post graduate programs approved by the Senate. All except the M.Sc (Range Management) program have been mounted at least once and the new Range Program is due to commence in 1989/90. The academic staff of 90 includes 60 Ph.ds. Similarly the faculty of veterinary medicine (founded in 1956) is organized into six academic departments including a department of animal production. The faculty has a staff component of around 100 and about 40% of staff time is devoted to research. Previously both the faculties have contributed through the involvement of staff and post graduate students in national research projects of both the Ministries of Agriculture and of Livestock Development. Beside, a large number of research projects have been supported by external agencies like IDRC in soil-water management, minimum tillage and pigeon-pea improvement; and CIP in potato. Some other ongoing research projects are sunflower breeding; research on neglected local vegetables; tissue-culture and microbiological research for inoculents in grain legumes; and research on rural factor markets, agricultural investments and farm productivity.

It is a pity, as the Dean of Agriculture told the authors, that whereas the faculty of agriculture in the University of Nairobi has been developed by generous IDA support, the institution had not participated in the formulation of the National Agricultural Research Project. There are only informal linkages with KARI. University researchers are conducting experiments on soil conservation at Katumani, while most of the post graduate students are from KARI. But, generally, the potential of research support by the University is ignored by both national and international research systems. There is no interface between ILRAD and the university faculties at Nairobi. To quote the Dean, "They have the best laboratories to tackle basic veterinary research in Kenya and perhaps the best in the world. We are across the street and we have no access."

There are three points to underscore, first the fragmentation of education and research efforts by the donor community including international centers; second, the underutilization of the human resources in the universities for contributing to national research productivity and, third, the narrow focus on governmental agencies without reference to educational institutions who provide the manpower for research. Perhaps, and this is a comment by the authors, the national governments also want to keep the universities at arms length, since they can be the hubs of dissent and sometimes quite volatile protest.

### RESEARCH-EXTENSION ON LINKAGE:<sup>37</sup>

Agricultural extension is one of the principal activities of the Ministry of Agriculture accounting for a large proportion of Ministry staff and expenditure.

According to Mr. E. Kandie, Director Agriculture, there are 8000 trained technical staff working at the headquarters provinces, districts, divisions locations and sub-locations. Average ratio of front line extension worker to farm family is 1:530. The technical staff deployed at the divisional levels are agriculture graduates with diploma holders at location/sub-location level.

Extension methods were changed several times over the past several decades. Three such approaches were the "farm management" approach of the late 1960's, and the "project development" and "complete package" approaches of the 1970's and early 1980's. Each was designed to attack what was perceived at the time to be a flaw in the way extension messages were delivered to farmers. Not only was the extension service fragmented among a large number of separate projects and different donors but extension activities tended to get lost among the range of other project or complete package activities.

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<sup>37</sup> / Authors are indebted to Permanent Secretary Mr. Namu, Director Mr. Kandie, Deputy Director Extension Mr. J.K. Gatheru, Deputy Director Farm Management, Mr. Joel M. Muasya and Head Development Planning Division Mr. J.K. Karanja for the discussion that follows.

In 1982, the extension service was reorganized under the National Extension Program. NEP is basically an attempt to reform organization and management of agricultural extension through the adoption of the "Training and Visit" (T&V) method of extension. T&V, is a tightly structured work program with regular and frequent visits to farmers and technical training for field agents. There is a hierarchical organization with specialists and supervisors and a focus by the extension service on extension work only. Also, a two-way communication both to farmers and from farmers is stressed to improve the quality of the extension message and increase the likelihood of technique adoption.

NEP was implemented by expanding the T&V method sequentially throughout the country. The program started in 1982 with two pilot districts, Kericho and Nandi. Eight districts were added in 1983 and ten more in each of the following two years. The current coverage of 30 districts includes all but the arid and semi-arid regions of the country.

NEP has addressed a number of key organizational and management problems. First, the goals and activities of the extension service have been clarified. There are work plans for field agents and commodity specialists detailing farm visits and training schedules. Second, the structure of the extension service has been re-defined with all components of extension integrated into the single national program. Third, extension messages have improved with more attention to comprehensive farm issues rather than monocultural production alone. More generally, there is a professional identity among extension agents with more of a focus on servicing the problems of farmers compared to earlier years.

However, the problems are the availability of relevant technical messages and the facilitating roles of credit and a stable input-delivery system. The first is contingent upon the crops, livestock, soil and water-management departments of KARI and the farm-management division of MOA jointly planning on-farm research and the senior subject matter specialists participating in the national factor/commodity specialist committee regularly organized by KARI management. The shift in KARI's locus from Ministry of Agriculture to the Ministry of Research has caused uncertainty in such interaction. As the Mid-term Review of NEP (July 1988) notes, "the pre-monthly workshop field visits, which were jointly undertaken by researchers and extension staff, have not been regular due to insufficient operational budget for both researchers and extension staff. Monthly workshops have been the key link between the research centers and the extension service in each district. However, in the last two years of the Project the participation of researchers in these workshops has declined partly due to insufficient operational budget and partly due to the lack of a firm commitment in the research establishment as to how much time research officers should spend in these workshops. The research/extension linkage in the area of on-farm trials has been weak throughout the Project period. On-farm trials could provide one of the most solid linkages if properly planned and implemented. It was found that most research centers were carrying out on-farm trials without involving extension staff. On the other hand in some districts some extension staff were carrying out on-farm trials without involving research officers.

On-farm research teams have already been established in eight Regional Research Centers but to a large extent they have not been sufficiently active.

The Agricultural Information Center (AIC), publishes research recommendations in the form of technical handbooks and handouts which are issued to all extension staff in the field. The AIC continues to function well in this respect but lacks the support and initiative of those who should provide the material for printing."

When Research and Extension were together in the Ministry of Agriculture, the Ministry with the National Extension Project funding could pick up the travel cost of researchers to workshops and on-farm trial sites. Now that KARI is in a different ministry such flexibility is lost and as we were told, farm management division in MOA might like to go ahead with on-farm trials autonomously. If that happens, the cleavage between research and extension will grow wider.

Mechanisms like Research Extension Liaison Division under KARI or Training and Development Division within MOA or Regional Research Center Advisory Committees including researchers, extension agents and representatives of farmer's organizations are all very logical methodologies on paper, but without adequate operational funds both for research and extension and a sequential development of research capability and extension messages, they will remain empty shells without substance and the meat.

There are other questions. First, it is not clear how relevant extension is for the less productive, non-high potential areas without generation of appropriate technical messages.

Second, contact farmers with exceptional resource-endowments may not be the most representative messengers to communicate new technical messages nor do they feel obliged to promote the dissemination of new messages to other farmers. A survey of 1988 by Development Planning Division noted that none of the farmers interviewed had been reached by extension agents. Authors were told by the Permanent Secretary MOA and the Director of Agriculture that more and more natural groups are being contacted rather than individuals. The African person is part of an extended family, part of an ethnic group with common thread of cultural heritage and esconsed in a protective network of solidarity.

Third, there are about 6500 women groups in the country, according to MOA, and women in Kenya do undertake a very major burden of food crop production. It is important that they are used by front line extension workers as contact groups. Labor constraints of women farmers, their complex tenurial problems, and lack of access to credit, need empirical investigation.

Fourth, interplanting of maize with other crops, for example, is an increasingly general practice by the smallholders but there are few, if any, valid or tested technical messages for mixed cropping conditions.

Finally, seasonal credit, input supply, and timeliness of output payments are crucial to dissemination of new or improved technology to

farmers. Hopefully, these other critical agricultural policy areas will receive the attention they deserve by the national government and their partners in development.

"Extension has great political appeal in that it provides a visible government presence in rural areas and suggests that governments are attempting to be responsive to local needs. Attempts to improve the productivity of existing extension services to achieve greater efficiencies obviously makes good economic sense. Also, where there are clearly demonstrated productivity gains to be achieved in high potential areas it obviously makes sense to improve the quality of extension.

If extension were to become the primary focus of an agricultural strategy to the detriment of an emphasis on other critical constraints on agricultural production (agricultural research, seasonal credit, input supply, timeliness of outpayments), this singlemindedness would be unfortunate."<sup>38</sup>

Linkages of veterinary research with the extension staff have been traditionally sound, because of the need to train staff in the use of the vaccine produced, and the need of scientists to monitor their effectiveness. Feedback is rapid and direct and informs the research strategy to be followed. Although, livestock and annual crop interaction in Kenya is traditionally effective, the temptation to amalgamate crop and livestock extension under one umbrella may be counter productive given the reality on the ground. Perhaps, the conventional wisdom that if something works push it is not such a bad adage.

### NATIONAL SYSTEM, INTERNATIONAL CENTERS AND REGIONAL PROGRAM

A new evolving relationship is emerging between Kenyan National Research System and the IARCs. The earlier perceptions, however, persists even today. TAC Report on Case Studies of Training in the CGIAR system, The Case of Kenya (October 1984) states, "The contribution of IARCs in strengthening national programs was inadequate, and this was mainly due to the fact that the regional representatives of IARCs serve too many countries in East Africa. This left them very little time to devote to national programs. In addition, programs there have also been conflicts between the national program leaders and IARC staff. Consequently, no research programs have been jointly formulated and discussed.

"One of the mandates of the IARCs is to provide improved germplasm which can be used by the national programs in developing varieties or hybrids to suit different environments. Kenya has participated in national nurseries which have benefitted the centers breeding activities more than the country's breeding programs. Most of the materials brought into the country are not found to be suitable for local breeding programs because no judicious selection of materials was made. Another point to note is that the nurseries

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<sup>38</sup>/ Uma Lele et al:opcit.

seem to be geared to serving short-term breeding programs but not long-term strategies." According to a senior Kenyan breeder, a trial should answer a researcher's own problems, or include lines in which he or she has participated in breeding.

There is need to reconcile the global priorities of International Centers and those of individual countries in Africa. Certainly, the activities of the centers cannot embrace the sum of individual priorities of all countries. Nevertheless, there can be a more effective mechanism for negotiating priorities with the national partners in the CG system. Sometimes, the independent governance of the centers, squeezed by pressure from national programs on the one hand, and by pressure for CGIAR systemwide activity, on the other, feel threatened about losing their independence and consequently are defensive, which often manifests as aggression.

However, a positive evolution is taking place both from the side of the national systems and from that of the Centers. ILRAD, a bastion of basic research with the very best of scientists and laboratories, is opening up to training more and more African scientists both through M.sc/Ph.d program and short-term diagnostic training and exposure including visiting fellowships. The Nairobi Cluster brings ILRAD and veterinary research in Kenya very close together along with sister institution like ICIPE. Linkage with the University of Nairobi still remains a problem.

Egerton University, KARI and CIMMYT are putting together a proposal for regional training for a six month production systems course at Egerton.

The Pasture Network of Eastern and Southern Africa, coordinated by ILCA has helped to improve the cooperation and trust between NARS and ILCA, the network's coordinating agency. The NARS see the network as an avenue for available to them for criticizing the shortcomings of ILCA in having a direct impact on NARS. Secondly, they see it as a way for them to attract the attention of the donor community to support research programs in feed resources which cannot be tackled by any country alone. Thirdly, and most importantly, they see the network as a way to exchange research information and ideas of national importance without necessarily having to publish this information in international journals. Agro-silvo-pastoral system is important for large areas in Kenya. A partnership relation should evolve, in that context, between ILCA and the national program.

There are other examples, like the East African Bean Network coordinated by CIAT, or the East and Southern Africa Root Crops Research Network exploiting limited resources and the expertise of the scientists within the region and from other organizations, to fulfill the objectives of their national programs. National committees for biological control is a useful model. In less than ten years the mealy bug problem is under control and illustrates very clearly the returns on research and training in Africa. Another example is the modestly funded network for the East African Microbiological Resources Center.

ICRAF (International Center for Research in Agro-Forestry) with its ecozone based network for the bimodal rainfall highlands of East Africa is integrated into the Kenyan national system for research on agro-forestry through a steering committee and national task force incorporating all the governmental agencies, research institutions like KEFRI and KARI, the universities and the concerned non-governmental organizations. The national blue-print has been planned and designed by the nationals while a strong premium is placed on human resources development. While agro-forestry is an old technology in Africa in which crops, animals and trees for multipurpose use are produced together in various combinations, modern agro-forestry embodies half old systems and half new scientific understanding of the nature of the interaction.<sup>39</sup>

ICIPE, an international center with charismatic African leadership clearly promotes trans-national cooperation in the continent of Africa. At the same time the Center has symbiotic relationship with the Kenyan national system. For example, it collaborates with the Nairobi cluster in vector research; with Kenyatta university in tick vaccine antigens; with KARI and MOA in integrated pest management research through plant resistance, cultural practice and biological control for crop pests i.e. stem borers, tse-tse control, and socio-economic studies to interface with and support the biological research in Kawale and Kilifi districts. ICIPE is active transnationally with various African national systems through Regional Pest Management Research and Development Network (PESTNET) and in research management through FAMESA (Financial and Research Management Projects in Eastern and Southern Africa).

What is equally important, however, is the African Regional Post Graduate Program in Insect Science (ARPPIS). ICIPE has agreement with fourteen (14) African universities. To date 61 Ph.ds (1983-89) have been trained in Insect Science. A novel aspect of the ARPPIS is that while ICIPE will concentrate on Ph.d courses, several African universities in different regions will offer M.sc. courses. For Southern Africa, the university at Harare will start the program this year. There will be similar arrangements for M.sc. training in designated universities in East and West and Central Africa. Instead of strengthening agriculture faculties all over Africa, is it possible to consider the prospect of specializations in various faculties according to their comparative advantages? The ultimate dream is of a Pan-African university or African universities in various regions and sub-regions with specializations in particular disciplines.

Another development is the organization of the African Academy of Sciences in 1986. That provides an opportunity to sensitize the African decision makers to the fact that science and technology are crucial to Africa's development. Networking of African Scientific Organizations; developing complete profiles of individual African scientists; establishing areas in science and technology which require strengthening either at the continental or national levels; appropriate placing of African scientists in areas of their specialization; facilitating closer contacts and sharing of

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<sup>39</sup>/ Discussions with Director Lungren.

facilities, information and experience between institutes and individual scientists engaged in similar or selected research activities; and getting involved in the long-term strategy for building up research capabilities and in planning for sustained development of the endogenous scientific leadership in Africa are, among others, the priority goals of the Academy. Beside, research output needs peer evaluation. African scientists have very limited opportunities to reach their colleagues through journals. The publication program of African Academy of Science is fulfilling this task through scientific journal and newsletters.<sup>40</sup>

If political commitment is a prerequisite for developing national scientific capability in agriculture, such indigenous professional associations are perhaps the most suitable conduits for bringing scientists the political leaders, the financiers and the entrepreneurs together. It is time perhaps for the donors to interact with such professional associations and jointly articulate the need for research in development. Incorporation of science and technology into African culture is vitally important.

### SUMMARY CONCLUSIONS

Human resources exist locally. They need to be upgraded and a long-term effort planned to bridge the critical gaps. It is necessary to promote an effective integration of research institutions and universities adopting wherever necessary, the "split degree" prepared jointly both in the country and in an advanced university and/or laboratory. Strengthening specialized disciplines in national universities within a regional context is a possibility that ICIPE is exploring with the national universities in Africa. ~~in a regional context.~~

The long gestation period of research is recognized both by the national system and the donors. The vicissitudes and instability of the national budget is a reality. In that context, the mode of external funding becomes important. Pre-financing by the national government for subsequent reimbursement by external resources results in excruciatingly slow disbursement and very little progress.

Erratic domestic and international funding exacerbates the imbalance between investments and operational funds. In Kenya, the scientists are there. They have no money to work with.

The donors are sometimes theology-driven and dismantle what works. For example, it is understood that parastatals are not, on the whole, particularly efficient. But there are exceptions. A tea development authority may not be chartered to do cereals research and extension. If that research and

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<sup>40/</sup> Authors are grateful to Professor Odhiambo and all his colleagues for the time they gave and for their insight.

development program works, it can incorporate other crops or trees in the tea based production system.

Socio-economic and agro-ecological constraints of small farmers have so far received more lip-service than substantive attention. National officials see the need for linking research and development with credit, input-delivery, marketing and timeliness of out payment. Beside, mixed/relay cropping continues to remain underresearched.

It is tragic to state that every aspect of the potential of women in African farming scenario goes unheeded except rhetorically. What the Kenyan woman does in the field and market dominates the observations of the casual observer. Yet, it is scarcely visible in programs, projects and reports except as a caveat or an after thought. Labor constraints of women farmers or the complex tenurial problems need both empirical investigation and policy analysis.

The forming of a partnership is a pre-requisite for effective action. Currently the atmosphere is filtered by whimsy. The donors, the international centers, the national institutions, the universities and development ministries all know best. In spite of a reasonable measure of donor coordination in Kenya, the partnership relations with the national system is yet to evolve. This situation aggravates the current uncertain environment for Kenyan agricultural research.

Reconstruction of past experiences of research in Kenya and in previous regional programs is essential in order not to reinvert the wheel. National scientists also feel the necessity of exchange of experience and information within the region for breaking their isolation.

Regional initiatives, however, should respond to and be compatible with the national program.

International centers, to be effective have to offer opportunities to the national scientists to substantively involve themselves in the research programming efforts of the centers so that national priorities can be related to the international agenda. The Centers also must actively participate in the articulation of national program priorities and lend their voice to identifying and easing local problems.

Finally, professional association like African Academy of Sciences brings together scientists, political leaders, financiers, and the private sector. Discreet long-term support to such African trans-national institutions and initiatives can help create a favorable political environment for research and development and sensitize African decision makers regarding the importance of science and technology for progress.

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