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Global Programs: A New Vision in Agricultural Research

Issues in Agriculture 12

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Issues in Agriculture is an evolving series of booklets on topics connected with agricultural research and development. The series is published by the Secretariat of the Consultative Group on International Agricultural Research (CGIAR) as a contribution to informed discussion on issues that affect agriculture. The opinions expressed in this series are those of the authors and do not necessarily reflect a consensus of views within the CGIAR system.



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About the CGIAR

The Consultative Group on International Agricultural Research (CGIAR) is an informal association of fifty-seven public and private sector members that supports a network of sixteen international agricultural research centers. The Group was established in 1971.

The World Bank, the Food and Agriculture Organization of the United Nations (FAO), the United Nations Development Programme (UNDP), and the United Nations Environment Programme (UNEP) are cosponsors of the CGIAR. The Chairman of the Group is a senior official of the World Bank, which provides the CGIAR system with a Secretariat in Washington, DC. The CGIAR is assisted by a Technical Advisory Committee, with a Secretariat at FAO in Rome.

The mission of the CGIAR is to contribute, through its research, to promoting sustainable agriculture for food security in the developing countries. International centers supported by the CGIAR are part of a global agricultural research system. The CGIAR conducts strategic and applied research, with its products being international public goods, and focuses its research agenda on problem solving through interdisciplinary programs implemented by one or more of its international centers in collaboration with a full range of partners. Such programs concentrate on increasing productivity, protecting the environment, saving biodiversity, improving policies, and contributing to strengthening agricultural research in developing countries.

Food productivity in developing countries has increased through the combined efforts of CGIAR centers and their partners in developing countries. The same efforts have helped to bring about a range of other benefits, such as reduced prices of food, better nutrition, more rational policies, and stronger institutions. CGIAR centers have trained more than 50,000 agricultural scientists from developing countries over the past twenty-five years. Many of them form the nucleus of and provide leadership to national agricultural research systems in their own countries.

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Acronyms Abbreviations

AARINENA	Association of Agricultural Research Institutions in the Near East and North Africa
APAARI	Asia-Pacific Association of Agricultural Research Institutions
ARI	Advanced Research Institute
ASARECA	Association for Strengthening Agricultural Research in East and Central Africa
CGIAR	Consultative Group on International Agricultural Research
CIP	Centro Internacional de la Papa (International Potato Center)
CORAF	Conférence des responsables de la recherche agronomique africains (Conference for Representatives of Agricultural Research in Africa)
FAO	Food and Agriculture Organization of the United Nations
GILB	Global Initiative on Late Blight
IARC	International Agricultural Research Center
IITA	International Institute of Tropical Agriculture
INIBAP	International Network for the Improvement of Banana and Plantain, IPGRI
IPGRI	International Plant Genetic Resources Institute
NARS	National Agricultural Research System(s)
NGO	Non-Governmental Organization
PROCI	Programa Cooperativo de Investigación (Cooperative Program for Agricultural Research and Technology Transfer)
Pro <i>Musa</i>	Global Program for <i>Musa</i> Improvement
SACCAR	South African Centre for Cooperation in Agricultural Research
UNDP	United Nations Development Programme

Preface

In 1994 at its Mid-Term Meeting in New Delhi, India, the CGIAR rededicated itself as a dynamic institution, driven by the research needs of developing countries and the scientific capacity of the international agricultural research centers, but conscious of financial realities. The vision which emerged from that meeting was of the CGIAR as a catalyst of sustainable development, with a renewed focus on continuing its record of research on problems of international significance in agriculture, livestock, forestry, and fisheries. Delegates to the meeting reaffirmed the need for the CGIAR to take a leadership role in the global agricultural research system and to carefully position itself as a research partner within that system, recognizing the work of other actors in developing countries as well as in advanced research institutes.

During the plenary session on the role and focus of the CGIAR in the global research agenda, I outlined the concept of global programs as a model for cooperation. Following the New Delhi meeting, the CGIAR launched its renewal process, seeking among other things, new and more efficient mechanisms to accomplish its research goals. Global programs have, indeed, emerged as such a mechanism. They involve broad partnerships among many research actors, with each participant having a unique and valuable role to play according to its comparative advantage; they can provide a financially efficient mechanism to address problems of a global nature; and, they can build and strengthen long-lasting, mutually supportive relationships among partners.

The centers of the CGIAR have moved forward in both developing and participating in global programs to enhance their research activities. This publication discusses the promises and the pitfalls associated with global programs and details the development of the Global Program for *Musa* Improvement and the

Global Initiative on Late Blight, representing two of the world's major food crops. The successful implementation of these two programs could serve as a guide for other efforts, and the accomplishments that we hope they will bring forth would inspire other global programs in the future.

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Chairman, CGIAR

Global Programs: A New Vision in Agricultural Research

EMILE A. FRISON, WANDA W. COLLINS, AND SUZANNE L. SHARROCK

Introduction

The world faces increasing poverty and more than 800 million people remain undernourished, despite all of the technological advances of this century, including the green revolution. Agricultural research faces the major challenges of increasing food production in a sustainable manner and improving family farm income in order to ensure household food security, while at the same time conserving the natural resource base. New tools, such as those provided by biotechnology and advances in information technology, provide opportunities to meet these challenges. However, to ensure that this is done with efficiency and equity, including a gender perspective, the appropriate approach to technology generation and transfer is essential. Researchers, extensionists, and end users must work together in a participative manner to increase production and productivity in a sustainable fashion, and to allow the benefits to reach the poorest and most needy of farmers.

In recognition of the enormous challenges that lie ahead, and of the need to make the most effective use of limited resources to tackle these challenges, a new vision of a global agricultural research system, building on strong cost-effective partnerships and a comprehensive global research agenda, has been elaborated. A significant challenge to the global system will be to devise instruments to effectively address such an agenda and bring partners together to implement research activities within it. This paper discusses one implementation mechanism: the development of participative global programs in spe-

cific problem areas. Two such programs which have recently been developed, the Global Program for *Musa* Improvement and the Global Initiative on Late Blight, are used as models to demonstrate the program development process.

A New Vision in International Agricultural Research

The need for a new vision in international agricultural research grew from a recognition that, in the same way that world food security is based on the principle of global food exchange, agricultural research is similarly a global concern. A clear need is seen to foster collaboration within the emerging global agricultural research system, to open the system to its stakeholders, and to solicit their participation in the strategy and priority setting processes. There is also a growing concern for the need to improve interaction among those who finance international agricultural research, those who contribute to the research—such as the international agricultural research centers of the CGIAR, other advanced research institutes, and national agricultural research systems of developing countries—and those who should benefit from the results and ensure their application.

The move toward closer partnerships at the global level has occurred in parallel with other changes in the external environment in which international agricultural research is carried out. National programs have become stronger, there is a greater involvement of non-governmental organizations in the implementation of development programs, and regional and subregional groupings (such as ASARECA, CORAF, and SACCAR in Sub-Saharan Africa, AARINENA in the Near East and North Africa, APAARI in Asia-Pacific, and the PROCIs in Latin America) have emerged as mechanisms to set priorities on a regional basis. In addition, ARIs, which include the agricultural universities and faculties of developed countries as a major component, are increasingly aware of the need for a greater level of involvement on their part in international agricultural research activities to solve critical problems of global concern.

An important step in developing a new vision of global partnership was an international consultation process convened by the International Fund for Agricultural Development. This consultation produced a "NARS Vision of International Agricultural Research" and resulted in a declaration and recommendations to strengthen NARS-CGIAR partnerships. It also identified the need to develop effective mechanisms to successfully implement an innovative new global agenda. The new vision of agricultural research requires new ways of thinking about partnerships and the implementation of high quality science, technology, and expertise in multidisciplinary research embracing both the social and biological sciences.

The CGIAR, in reviewing its role within the global agricultural research system, and in recognition of the need to become a more effective and efficient partner, launched a program of renewal and rededication in 1995 (CGIAR 1995). As part of the renewal process, the CGIAR is seeking to strengthen its partnerships with NARS, regional organizations, ARIs, NGOs, farmers and farmer organizations, and the private sector. Partnerships are essential as a means to improve research relevance, increase ownership of the South in the CGIAR system, tap additional resources, and pursue research in a more coordinated fashion. Although the CGIAR is a relatively small component of the global system, it is uniquely placed to serve as a bridge between developing country research systems and ARIs in industrial areas, such as the United States, Europe, Japan, and Australia. It can also act in a facilitation role to promote more private sector involvement and to define modalities for that involvement.

In 1996 the first Global Forum on Agricultural Research was held (CGIAR 1996). This was the first time that the various components of the global agricultural system had been brought together to explore the needs and opportunities for agricultural research. The Global Forum manifested the resolve of the international community to integrate its best scientific talent in order to maximize its agricultural research capacity. It culminated in the adoption of a *Declaration for Global Partnership in Agricultural Research*.

Global Programs

In adopting the *Declaration for Global Partnership in Agricultural Research*, the international community committed itself to fostering the participation of all stakeholders in research collaboration. The CGIAR is fulfilling this commitment in a number of ways, including its encouragement of, and participation in, global programs for agricultural research.

What is a “Global Program”?

It is increasingly recognized that many research problems are global in nature. It is also clear that individual institutes do not possess all of the skills and facilities necessary to address major international research issues. The problems are usually of such magnitude and are so crucial to world food security that partnerships are essential. Within the context of global programs, partnerships are developed, fostered, and ensured. A global program, thus, consists of a coordinated set of activities, carried out by a wide range of program participants, or partners, and directed toward solving a specific problem or set of problems identified at the global level. A global program can also be considered as:

- a set of partnerships;
- a forum for setting global research priorities;
- an umbrella for improved funding possibilities for program participants through the recognition of the program by donor agencies;
- a mechanism to promote close interaction among, and knowledge of, research teams within an area of specialization;
- an opportunity for interdependent research projects (i.e., projects requiring interdisciplinary and complementary partnerships); and

- an opportunity for improved access to information and resources.

The overriding aim of developing a program in this way is to create “added value” through more efficient partnerships and the sharing of information, materials, and results. In other words, the output of the program as a whole will be greater than the sum of its component parts.

Two important principles that should be applied within the context of global programs are those of equity and subsidiarity. All partners in a global program should have an equal status, and benefits from the program should be shared with equity. Furthermore, according to the principle of subsidiarity, the primary responsibility for an activity should be devolved to the lowest level in the hierarchy—from global to regional to national—where it can be carried out most effectively and efficiently.

Global programs can be illustrated by an actor x program matrix, in which each actor is represented by a row and each global program by a column, as shown in Table 1.

Table 1. The Global Program Matrix

ACTOR	GLOBAL PROGRAM A	GLOBAL PROGRAM B	GLOBAL PROGRAM C	GLOBAL PROGRAM D
ARIs	•	•	•	•
IARCs	•	•		•
NARs	•	•	•	
Universities	•	•	•	
Private Sector	•		•	
NGOs				•
Other		•		
Other			•	

Who is Involved in Global Programs?

Ideally, all of the major players and stakeholders with an interest in addressing a particular problem or set of problems should participate in a global program. The many actors may include ARIs, NARS, the private sector, NGOs, IARCs, and farmers themselves, all of whom play contributing and complementary roles. Developing a global program will allow the various actors in the global scene to be brought together, their respective roles clarified, and collaborative partnerships established. The initiation of a global program can be led by any of the actors; however, a goal of paramount importance in any global program should be to identify and include those researchers already involved and recognized in the chosen area. They will have been successful in raising resources to support their activities and will provide the program with a solid base of experience. The participation of other actors is based solely on their ability and willingness to contribute to the overall program aims.

What are the Benefits of Global Programs?

As a set of partnerships. With limited resources, maximum efficiency in agricultural research is essential. A number of steps can be taken to ensure efficiency, including: assembling all of the possible partners; making the best use of available resources; avoiding duplication of efforts; and, adding value through the creation of synergies among partners. Such measures can be achieved within the context of global programs which operate on the basis of partnerships. Participation in such programs facilitates networking as a *modus operandi*, with partners contributing resources and participating in two-way communication and exchanges of information. Partnerships among NARS and ARIs can also play a major role in capacity building at the NARS level. The forging of closer ARI-IARC-NARS partnerships was a specific recommendation resulting from the Global Forum on Agricultural Research.

As a forum for setting global research priorities. Bringing together all of the major stakeholders in a program provides the ideal forum for setting program priorities. This must be carried out

at the global level with the participation of all players, thus minimizing the duplication of effort and increasing the efficiency with which funds are used—two of the major goals of effectively implementing the global agricultural research system. A critical component of any global program is, therefore, to establish an effective and agreeable mechanism of setting priorities.

As an umbrella for improved funding possibilities for program participants. The development of a global program to address a specific problem area allows the coordination, not only of research into that problem, but also of the funding for such research. Indeed, the donor agencies are considered as partners in such programs and play an important role in program development. The involvement of donors ensures their recognition and understanding of the problem being addressed and, hence, enhances the possibilities of funding for all component parts of the program. In addition, a program in which priorities have been set and strong partnerships, which will result in added value, have been established, is likely to be attractive to the donors.

As an opportunity for interdependent research projects. Projects which require interdisciplinary and complementary partnerships can be readily accommodated within the framework of a global program. The bringing together of all of the major players provides a mechanism to promote close interaction among research teams and, thus, facilitates the identification of complementary skills and resources. This in turn creates the opportunity for the development of interdependent and interdisciplinary research projects.

As an opportunity for improved access to information and resources. The close partnerships which underpin global programs result in the rapid, informal exchange of information among program participants. In addition, through, for example, program meetings and workshops, research activities can be discussed and results disseminated. Information exchange is, indeed, recognized as a particularly important function of global programs.

What are Some of the Major Challenges in Establishing a Global Program?

Oversight. Oversight for a global program is required to ensure that the program addresses the identified needs in the most efficient and effective way and to ensure that, as the program develops, the aims and objectives continue to be appropriately addressed. Oversight may be provided by a steering committee made up of representatives of the major stakeholders. In addition, representation by the major regional groupings, which have emerged as mechanisms to set priorities on a regional basis, can ensure the relevance of global programs within the context of the overall global agricultural research system. Appropriate oversight is necessary to assure donors that efficiency is, indeed, resulting from the investment.

Coordination and transaction costs. Good coordination is essential to ensure the success of a global program. The coordinating body should play an "honest broker" role, and must ensure that all program participants are kept informed of overall program progress, that partnerships remain close and active, and that information is circulated freely and efficiently between all program partners. This includes the preparation and distribution of reports on program progress, as well as the organization of program meetings, conferences, and workshops. In addition, coordination also involves a "secretariat" function to the program. Coordination should be accomplished from a site which has sufficient existing support resources; for example, a reliable communication mechanism and ready access to information sources. The costs associated with coordination, or "transaction costs," are not negligible if the number of participants in the program is large; however, these should be looked at in comparison with the total program investment (i.e., the sum of the investment of each program partner), which with a large number of participants will be considerable. What is important is that the added value created by the program outweighs the transaction costs by a sufficiently large factor.

Communication. Significant advances in communication technology have been made in recent years and these should be used in

global programs to ensure rapid and efficient information exchange. However, it is clear that not all program participants will have access to the latest technologies. The lack of these tools must not result in isolation or exclusion of potential partners. A challenge that must, therefore, be addressed within the context of global programs is to ensure that, while information flows efficiently and the best use is made of the latest technologies, all participants are able to access and distribute information. In addition, a global program must create a working environment which encourages all partners to willingly share information. Global programs operate on the basis of equal and open partnerships, and participants must feel confident with this mode of operation.

Activities and resources. The research activities carried out by program participants constitute the core of a global program. These activities may be carried out by individuals, institutes, or groups of institutes. Whatever mechanism is chosen, activities must be carried out by those with the greatest advantage to do so. Activities may be funded by a range of mechanisms and may be of varying duration and complexity. The majority of the resources required for activities carried out within the framework of a global program will be brought into the program by program partners. However, there will also be a need for further funding to support additional research needs as identified by program participants, and to cover the transaction costs of the program. It is important that this latter cost is recognized and provisions are made to cover this right from the planning stage of the program.

Priority setting and resource allocation. While it is true that bringing together all of the major stakeholders in a program provides an ideal opportunity for setting priorities, a mechanism must be put in place to ensure that this is done objectively. A major challenge that must be recognized and addressed is the possibility that program participants may be tempted to bias the priority setting process in their favor. In order for the program to be effective and for participants to benefit from it, they must be willing to forgo a certain level of independence. Overall program objectives must take priority over indi-

vidual objectives, compromises may be necessary, and professional jealousies must be overcome. Ensuring that all participants are fully committed to overall program aims, and that these aims have been set in a participatory manner, is one way that these problems may be overcome.

Having determined program priorities, a related issue is to ensure that resources are appropriately allocated to these priorities. Although many of the activities included in a global program are brought in already funded, these activities may not necessarily be of the highest priority to the program as a whole. One benefit of operating as a global program is that funding gaps can be readily identified once priorities have been set. While the identification of funds to fill gaps will remain a major challenge, it is possible that funding agencies may be more interested in funding pieces of research when it is clear where they fit into the overall research effort, than if they are presented in isolation.

Accountability. Accountability is necessary at various levels within a global program, and mechanisms to ensure this must be put in place. At the highest level, the program itself must be accountable to the global agricultural community—the global system, and through this, to the end users. In addition, participants in the program are accountable to the program as a whole as well as to the program's donors. The standards of accountability must be articulated and understood at the earliest stages of program development.

The Role of the CGIAR in Global Programs

The CGIAR is an important, but small, actor in the international agricultural research scene, accounting for only about 4 percent of global expenditures on agricultural research for developing countries. By participating in global programs, either through taking the initiative to develop them when appropriate or becoming a partner in those developed by others, the CGIAR can play an important role, particularly in providing the link between developing country NARS and the more advanced research institutes of developed countries. Several efforts are underway involving centers of the CGIAR. Two

relatively new programs for which CGIAR centers played key initiating roles are the Global Initiative on Late Blight, spearheaded by the International Potato Center (CIP), and the Global Program for *Musa* Improvement, initiated by the International Network for the Improvement of Banana and Plantain (a program of the International Plant Genetic Resources Institute), and the World Bank. GILB and Pro*Musa* differ in the way they were developed, in their organizational structure, and in their mode of operation. Many of these differences are due to the nature of the two crops they cover, the extent and location of research already underway, and the remaining work to be done; however, both embody the main principles of global programs and follow the same reasoning for their development. Further details of the background, development, and structure of these innovative programs are provided below as models to address the issues which are critical to the successful implementation of such programs.

The Global Program for *Musa* Improvement (Pro*Musa*)

The development of Pro*Musa* was initiated by INIBAP and the World Bank (Frison *et al.* 1997). Both organizations are currently implementing *Musa* research programs with components in *Musa* improvement. Because of the importance of *Musa* and the limited funding available on a global basis for improvement, the potential to bring research partners together under the framework of a global program was seen as an exciting prospect for maximizing progress and the benefit from research investment.

The Need for a Global Program

Bananas and plantains are one of the world's most important yet poorly studied crops. In terms of gross value of production, bananas and plantains are the fourth most important global food crop (Tribe 1994). Export bananas are the fourth most important commodity and, as a fruit, rank first. Bananas and plantains constitute a major staple food crop for millions of people in developing countries of the

tropics. They are grown over a harvested area of approximately 10 million hectares, with an annual production of around 86 million metric tons (FAO 1995). The vast majority of producers are small-scale farmers growing the crop either for home consumption or for local markets. Bananas and plantains grow in a range of environments and will produce fruit year-round, providing a source of energy during the “hungry period” between crop harvests. As well as being a cheap and easily produced source of energy, they are also rich in vitamins. It is for these reasons, and the fact that they provide a valued source of income through local and international trade, that bananas and plantains are of major importance to food security.

Bananas grown for export—which are almost exclusively of one variety, Cavendish—account for little more than 10 percent of global production. The remaining 87 percent or so of production is made up of a very wide range of varieties, each adapted to a specific ecoregion and selected for specific eating or cooking qualities. These include the true plantains of West Africa and Central and South America, the highland bananas of East Africa (which in addition to being a staple food crop are also used to make beer), the cooking bananas of Southeast Asia and the Americas, and the Pacific Maia Moali/Popoulu type of banana (INIBAP 1994).

In recent years, banana and plantain production worldwide has become increasingly affected by growing pest and disease pressures, the most notable example being the rapid global spread of the fungal disease black Sigatoka (*Mycosphaerella fijiensis*). The disease was originally identified in Fiji in 1964, and its first appearance outside of Asia was in Honduras in 1972. This was followed by the development of a serious epidemic throughout Central America. In Costa Rica alone, the cost of controlling the disease during the 1980s was estimated at approximately US\$17.5 million per year (Gowen 1995). By the late 1970s the disease had spread to Africa, where it has now been recorded in nineteen countries. The spread of this disease to Africa, and its potentially devastating consequences to smallholder producers, was one of the factors which led to the creation of INIBAP in 1984. The most important and widely grown cultivars are susceptible to black

Sigatoka, which causes severe leaf necrosis and can reduce yields by 30 to 50 percent (Stover and Simmonds 1987).

Considerable losses are also caused by a soil borne disease, Fusarium wilt (Panama disease), which is present in virtually every area where bananas are extensively grown and which affects many important cultivars of banana and plantain. Viruses are also a major constraint to production and can cause losses of up to 100 percent in some areas (Brunt *et al.* 1990). In addition, a complex of plant parasitic nematodes cause serious yield reductions in all regions (Speijer and De Waele 1997).

Chemicals can be used to control many of the pests and diseases affecting banana and plantain production, but the costs, both economically and environmentally, are high. The need for resistant cultivars as the main component of an integrated system for pest management is imperative. Resistant varieties are needed which are suitable for the varied needs of smallholder producers in many countries worldwide. Economic studies carried out by the International Institute of Tropical Agriculture on plantain production in West Africa have shown that the use of black Sigatoka resistant germplasm can have a comparative advantage of 10:1 over fungicide use. From this, it has been estimated that the use of black Sigatoka resistant varieties could have an impact of some US\$6.2 billion per year for Africa as a whole (Ortiz and Vuylsteke 1994).

Biologically, *Musa* improvement is very difficult due to the intrinsic difficulties in breeding a crop in which almost all of the important cultivars are highly sterile. Consequently, few funds were directed toward *Musa* improvement research and very few national programs had the resources to embark on *Musa* breeding research. Recent developments in breeding and biotechnology have allowed some of the barriers to genetic improvement to be overcome, and significant progress has been made.

Nevertheless, the genetic improvement of bananas and plantains remains an expensive and slow task, and, considering the scale and

diversity of the problems facing banana and plantain growers worldwide, *Musa* improvement efforts are still underfunded and insufficient. It is only through close international collaboration, drawing together and building on the limited number of ongoing initiatives in *Musa* improvement, that a significant impact can be expected in years to come.

Establishment of the Program

During 1996 it was proposed that a global *Musa* improvement program should be developed with the aim of bringing together all of the major efforts in the area of banana and plantain improvement worldwide. INIBAP and the World Bank, through a participative process involving extensive consultation with more than fifty individuals and partner institutes in the scientific and donor communities, developed an initial proposal for the program. IITA, which has a very important *Musa* improvement program, was also an important contributor at this stage. The proposal was further refined through continued interaction, incorporating inputs and suggestions received from many partners.

This participative approach enabled INIBAP to produce a final draft proposal which represented the views of a wide range of interested parties. The proposal incorporated a list of priority areas for research based on the experience of researchers in both developed and developing countries who were involved in the participative process of developing the proposal. A tentative structure for the program was proposed based on the suggestions of the potential partners. This proposal was presented at a meeting jointly organized by INIBAP and the World Bank that brought together more than seventy researchers involved in *Musa* improvement, as well as representatives of the donor community. During this meeting, and after much debate and discussion of different views, the program structure, *modus operandi*, and a medium-term plan of activities were agreed upon. The process was an iterative one, with groups meeting, formulating proposed activities, discussing, reformulating, and finally presenting to the group as a whole for agreement and approval. As a result of the general agreement reached through that intense, collabo-

rative, and open process, the Global Program for *Musa* Improvement was formally launched in March 1997.

ProMusa was developed as a broad based program aiming to involve all of the major players in *Musa* improvement, and as a means to link the work carried out to address the problems of export banana producers with those initiatives directed to improve banana and plantain production at the subsistence and smallholder level. The global program builds upon existing achievements and is based on ongoing research initiatives. *ProMusa* is, therefore, a mechanism to further maximize the outputs and accelerate the impact of the overall *Musa* improvement effort. The program is an innovative mechanism to bring together research carried out both within and outside of the CGIAR, creating new partnerships between NARS and research institutes in both developing and developed countries. It is also hoped that *ProMusa* will provide a suitable framework within which the private sector can be encouraged to actively participate in *Musa* research activities.

The strategy of *ProMusa* is to produce improved, farmer accepted, *Musa* varieties through the development and application of conventional and biotechnological breeding approaches, incorporating resistance to pests and diseases to increase productivity and reduce pesticide use, and operating in an environment in which collaborative partnerships and close interactions are fostered.

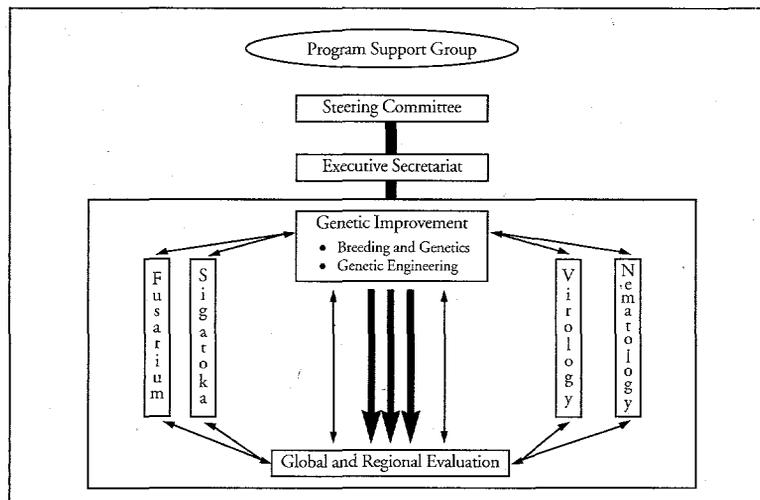
The structure of *ProMusa*, agreed upon by all of the participants in the program, is presented in Figure 1 [see page 16].

Partnerships within *ProMusa*

Partnerships will underpin this global program and are intended to be active at all levels of program management and implementation. The program, when fully functional, will operate as a series of interlinked thematic working groups coordinated by an executive secretariat. It is directed by a steering committee, which has been chosen to represent NARS, ARIs, and IARCs. *ProMusa* operates under a program support group, composed of major donors and

stakeholders and which held its first meeting in Cairo in May 1997. While modalities of operation are not fixed, ProMusa intends to operate as a consortium relying on a range of funding mechanisms. Partners in the program are expected to contribute in-kind research activities which they have underway that address the goals and objectives of the global program. In addition, the program will seek further resources to address priority research needs, as identified by program partners. Participation in ProMusa is based on the capacity to contribute through a high scientific capability in *Musa* improvement research and on comparative advantage within that research agenda.

Figure 1. The Structure of ProMusa



Research teams will operate through the formation of key thematic working groups, which function as networks, as shown in Figure 1. Through this mechanism, the formation of collaborative projects between working group members, resulting in a division of labor and the creation of synergies, is facilitated. The working groups are the heart of the program. The members of these groups will implement the program workplan through a project portfolio, developed by the group, addressing their specific problem area. It will

include projects carried out by individual participants, as well as collaborative projects involving a number of participants funded through various mechanisms. Working groups have been established to cover the major research needs, which at this stage include genetic improvement, Fusarium wilt disease, Sigatoka disease, nematodes, and viruses.

Decisionmaking within ProMusa will follow a bottom-up approach, and participating scientists will be fully involved in this process. Decisions on program activities will be based on scientific priorities identified by program participants which are themselves based on user needs.

INIBAP is responsible for providing the executive secretariat to ProMusa. With the close links it has already established with many national programs through regional banana research networks, it is ideally placed to foster close collaboration between program participants.

Program Activities

The major thrust of ProMusa is to develop a wide range of new banana hybrids suitable for production under varying environmental conditions by banana growers worldwide. To this end, the program brings together conventional breeding based on hybridization techniques with genetic engineering and other biotechnological approaches. Ongoing and new research will be directed toward developing efficient breeding strategies based on the identification and use of new sources of resistance and on the integration of conventional breeding and biotechnology methodologies. This includes the identification of molecular markers and their use in marker assisted breeding and the development of biotechnological tools to further strengthen breeding programs. The aim is to produce, for the different types of bananas, disease and pest resistant varieties with a wide genetic base.

This broad-based genetic improvement effort will be supported by research being carried out by three working groups focusing on

Sigatoka disease, Fusarium wilt, and nematodes. Such research will contribute toward the identification of sources of resistance to these pathogens and to a better understanding of the types of resistance and their inheritance. In addition, information will be gathered on pathogenic variability and the geographic distribution of the major nematode pest species and of the Sigatoka and Fusarium fungi.

A further working group will conduct research on the control of the major viruses in *Musa* through the production of transgenic virus-resistant clones and on the development of robust diagnostic systems in order to facilitate germplasm movement.

Improved varieties produced within the framework of Pro*Musa* will be evaluated and disseminated through a global and regional evaluation program. The participation of NARS in this activity will ensure not only that improved hybrids will be made available to them at an early stage, but also, through the creation of linkages, that the two-way flow of information between breeding/research programs and evaluation sites will be facilitated. The global and regional *Musa* germplasm evaluation program, therefore, will play a major role in Pro*Musa*, providing a mechanism for information exchange. INIBAP's International *Musa* Testing Program, which was launched in 1989 with the support of UNDP, has recently been restructured in order to better serve the evaluation and dissemination needs of Pro*Musa*. The provision by NARS of feedback regarding farmer needs is of particular importance in setting research priorities. The existing regional banana research networks also provide a useful channel through which information from national programs will be fed back to the global program.

The Global Initiative on Late Blight (GILB)

The Need for a Global Program

Late blight disease of potato, caused by the fungus *Phytophthora infestans*, results in losses of approximately US\$3 billion annually around the globe and can destroy a healthy crop in a matter of days, given the proper environment for the development of the fungus.

Late blight originated in Latin America. The most common form of the fungus, the A1 mating type, spread from Latin America to Europe in the nineteenth century and played an important role in the Irish potato famine. It is the world's most devastating crop disease and is a source of serious concern in both developed and developing countries (CIP 1996).

In developed countries the disease is normally controlled by fungicides; however, in recent years, scientists have seen new forms of the pathogen develop, some of which are showing resistance to at least one of the commonly used and most effective fungicidal controls. Resistant strains of the pathogen are now found in all potato growing areas. There is growing concern about the increase in the incidence of the disease and the environmental effects of using more toxic fungicides for control. As a result, developed countries are increasing their already significant investments in research to control the disease. In developing countries, where farmers cannot afford expensive fungicide inputs, the disease often remains unchecked.

The problem has been worsened by the spread of a second form of the pathogen, the A2 mating type, from Latin America to virtually all parts of the world. The presence of both the A1 and the A2 mating types offers the potential for sexual recombination between the two types with the result being new and possibly even more virulent strains of the pathogen.

At a time when potato production is growing at an unprecedented rate in developing countries, where it is providing both much needed food and a source of income, and where a third of the world's crop is expected to be produced by the year 2000, late blight is, indeed, a serious and increasing threat to future world food security.

The magnitude of the current losses to potato production, the threat posed by the fungicide resistant strains, and the escape of the second mating type, pointed to the urgent need in the eyes of international researchers to launch a directed global campaign against the disease. As a major player in the global research effort to control late

blight, CIP along with its national collaborators in developing countries conceived and pursued the establishment of the Global Initiative on Late Blight.

Establishment of the Program

CIP began efforts to build support and define the objectives of GILB in 1995 through extensive individual contacts with other major researchers around the world, both in developing country NARS and in developed country ARIs. Representatives of the private sector were consulted regarding their interest in supporting and collaborating in research. The principal focus of the initiative was seen to be "...the development of cultivars with durable resistance to numerous variants of the fungus that are appropriate for use in integrated disease management programs in developing countries" (French and MacKay 1996). These participatory development efforts culminated in a global project design workshop in 1996 in which many of the most noted late blight researchers in the world participated. The objective of the workshop was to provide an international forum to set priorities for the initiative, develop a plan of activities formulated around priorities, and propose an organizational *modus operandi*.

Workshop participants agreed that a Global Late Blight Network should be established to link all participants with activities relevant to the objectives of GILB. A three-phase project life covering a ten-year period was envisioned with priorities changing from phase to phase, depending on progress achieved. A total investment of US\$25 million over the ten-year life of the initiative was estimated to be able to achieve the rapid progress necessary to successfully meet the global challenge of late blight.

A steering committee made up of nine internationally-known individuals, with a wide representation of partners, was agreed to as a guiding component for the initiative, and has been established.

In addition, a management entity comprising a coordinator, coordinating secretariat, and appropriate support staff was agreed.

Functions and activities of the management entity include:

- constituting the global late blight network;
- organizing support;
- allocating resources;
- providing accountability and reporting structures;
- facilitating scientific exchange and communications;
- ensuring quality science;
- providing open access and ensuring transparency;
- providing oversight to the coordinating secretary; and
- further evolving its own role, responsibilities, and structure.

CIP was chosen as the convenor of the GILB and the location for the coordinating secretariat. An organizational diagram is shown in Figure 2 [see page 22].

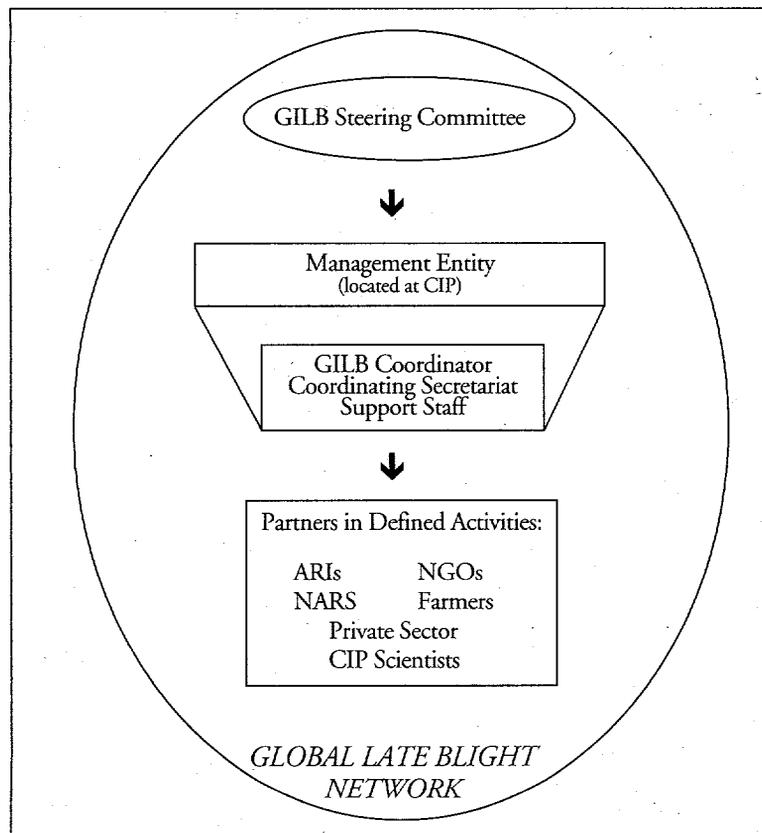
Partnerships within GILB

Like *ProMusa*, the concept and realization of GILB follows the pattern of equitable partnership necessary for the success of global programs. It is organized in a loosely structured fashion, owing to the numerous and often very strong research programs which already exist to address the late blight problem. GILB will function essentially as a facilitator to focus efforts toward the solution of the problem and to identify gaps where research needs to be done and niches where new partners can be valuable.

The CGIAR is present in the form of CIP, which acts both as a facilitator for the initiative and a full research partner. CIP's facilita-

tion role centers around partnerships involving ARIs of developed countries, now working intensively in late blight control, NARS collaborators in developing countries, which are full research partners and which will also aid in transferring newly developed technologies to end users, NGOs that will act as valuable research allies and technology transfer conduits to small farmers, and the private sector, which could furnish highly specialized technologies and funding.

Figure 2. The Structure of GILB



With potatoes, the presence of a private sector with strong research capability and interest in late blight provides an opportunity to develop carefully conceived modalities to capitalize on that expertise and involve the private sector in the production of technologies that can be considered international public goods.

Bilateral as well as multilateral partnerships among these participants will be encouraged and supported. The formation of the Global Late Blight Network is intended to provide a means to foster such partnerships.

Program Activities

Priority in Phase I activities, as determined by participants at the global design meeting, is allocated to problems which are basic to the success of developing resistance to late blight and which can be achieved in the time allocated. They are:

- using existing breeding materials to improve horizontal resistance to late blight in tubers and foliage;
- upgrading and extending present genotype by environment studies for foliage resistance;
- refining and standardizing testing for both foliar and tuber resistance;
- developing molecular tools for application in practical breeding;
- genetic studies using molecular techniques (i.e., map based cloning and/or transposon tagging of vertical resistance genes and identification of quantitative trait loci); and
- updating current integrated pest management studies and related transfer of technology.

While transgenic approaches were seen as having high priority at some point, workshop participants agreed that other critical activities must be accomplished first. Hence, transgenic approaches were given high priority in the third phase of the initiative.

At their first meeting in Washington in January 1997, the steering committee reaffirmed the mandate of GILB as being to reduce the threat that late blight is posing to the potato crop, especially in less developed countries, through stimulating collaborative and complementary research and technology transfer among developing and developed countries. Three broad general objectives were identified through which to accomplish the mandate:

- fostering high priority research;
- enhancing communications between all stakeholders; and
- assisting, promoting, and catalyzing technology transfer, focusing on where there is greatest need and potential impact.

The steering committee outlined specific activities within each objective which should be undertaken.

Conclusions

Global programs such as *ProMusa* and GILB, which have broad participation from worldwide partners, including IARCs, ARIs, and NARS, allow research priorities to be established at the global level, while the work itself is carried out mainly at the national or regional level. Comparative advantages are fully exploited, while at the same time fostering the principles of subsidiarity and equity. In other words, research is carried out at the lowest possible level of the global-regional-national hierarchy, and efficiency and effectiveness are maximized in an equitable fashion.

The difficult issues associated with global agricultural research are not necessarily minimized themselves by the formation of global programs. Priority setting remains a difficult and contentious issue, resources still have to be mobilized, and technologies still must be developed and transferred. The value of global programs is that they provide one route for the relevant set of actors in the global community to come together, each with its own comparative advantage, and work in unison to achieve the goals they have set for themselves with a synergistic effect that adds value and makes the entire process more effective and more efficient.

Participants in global programs benefit in many ways including:

- global prioritization of research needs;
- improved possibilities for funding for program participants through the recognition of the program by donor agencies;
- close interaction with, and knowledge of, other research teams within their area of specialization;
- opportunities for interdependent research projects (i.e., projects requiring interdisciplinary and complementary partnerships);
- improved access to information and resources; and
- participation in program meetings and conferences.

Global programs encourage new and innovative partnerships to be forged between the various program participants, thus facilitating the creation of synergies. They also play an important role in information exchange and result dissemination. With the participation of both the private and public sectors in global programs, they provide the opportunity for the discussion of issues of a global nature, such as intellectual property rights, which have implications for program

implementation. In addition, the involvement of NARS as partners at all levels has the effect of strengthening the capacity of such NARS to conduct specific crop related research and of facilitating the transfer of technology and expertise.

Global programs also serve as a valuable mechanism for universities and other ARIs to increase their involvement in international agricultural research and become more important partners in the global agricultural research system in a focused and cost-effective manner. The centers of the CGIAR can play an "honest broker" role and serve as the focal point for the development of global programs over a wide range of specific topics and crops, with the resulting increase in effectiveness and efficiency and strengthening of partnerships foreseen by the renewal and rededication process launched by the CGIAR in 1994.

Although they are only one of many innovative and worthwhile approaches to resolving global agricultural problems, the advantages of global programs are considerable. Both *ProMusa* and GILB have laid the foundation for success through different, but equally valid, routes to global partnerships. The lessons learned over the next three to five years as these pioneer programs mature will set the stage for further development of successful global programs to address critical research problems.

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About the Authors

Emile A. Frison is Director of the International Network for the Improvement of Banana and Plantain, a program of IPGRI, based in Montpellier, France. He has spent most of his career in international agricultural research, starting at IITA, Nigeria in 1979. A plant pathologist by training, Dr. Frison obtained an M.S. from the Catholic University of Louvain and a Ph.D. from the University of Gembloux, Belgium. He worked for six years in Africa, in Nigeria and Mauritania, and was Development Manager of an Agrochemical company in Belgium for three years. In 1987, he joined IPGRI (then the International Board for Plant Genetic Resources) to coordinate research on the phytosanitary aspects of international germplasm movement. In 1992 he became Regional Director for Europe and initiated a new phase of the European Cooperative Program for Crop Genetic Resources Networks, which developed into the platform for the implementation of the Global Plan of Action on Genetic Resources for Food and Agriculture in Europe. In collaboration with FAO, he also launched the European Forest Genetic Resources Program, as the mechanism for the implementation of Resolution 2 of the Ministerial Conference on the Protection of Forests in Europe. Dr. Frison is author and coauthor of over 100 scientific publications.

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