Networks, Working Groups, and Their Role in Enhancing Collaborative Research in Groundnut

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Abstract

Agricultural research networks are tools for strengthening agricultural research in developing countries by using existing facilities and staff more effectively. This tool avoids duplication of effort and can make available a critical mass of research effort to solve specific problems at a relatively low cost.

This paper briefly reviews how networks are organized and operate; how scientists in national programs can strengthen their personal scientific capabilities and upgrade their research; what pitfalls National Agricultural Research System (NARS) administrators must consider in becoming involved; and the ways in which International Agricultural Research Centers (IARCs) use networks to expand their information bases and share their material and information with NARSs.

*It then outlines the organization of the Asian Grain Legumes Network (AGLN) and other networks facilitating collaborative research on groundnut (*Arachis hypogaea*). Finally it examines the concept of Working Groups and how they are being used by the AGLN to focus and strengthen collaborative research on groundnut.*

Résumé

Réseaux, groupes de travail et leur rôle pour le financement de recherche en collaboration sur l'arachide: *Les réseaux de recherches agricoles sont des outils pour renforcer la recherche agricole dans les pays en développement en utilisant plus efficacement les moyens d'action existants et le personnel. Cet outil évite les doublements d'efforts et peut fournir une masse critique d'efforts de recherches pour résoudre des problèmes spécifiques à un coût relativement modéré.*

Cette communication examine brièvement comment les réseaux sont organisés et fonctionnent; comment les scientifiques des programmes nationaux peuvent renforcer leurs potentiels scientifiques personnels et promouvoir leurs recherches; quels pièges les administrateurs d'un Système national de recherche agricole doivent risquer de subir; et les manières dont les centres internationaux de recherche agricole emploient des réseaux pour élargir leurs bases d'information et partager leur matériel et l'information avec les Systèmes nationaux.

*Ensuite, la communication décrit brièvement l'organisation du réseau asiatique des légumineuses à grain (AGLN) et d'autres réseaux qui facilitent la recherche en collaboration sur l'arachide (*Arachis hypogaea*). Finalement elle examine le concept des groupes de travail et comment ils servent à l'AGLN pour concentrer et renforcer la recherche en collaboration sur l'arachide.*

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Networks and networking are increasingly attracting attention as a means for using facilities and staff more effectively. This approach is used to avoid duplication of effort and to engage, at relatively low cost, a critical mass of personnel in research to solve specific problems. Networking is a tool to strengthen agricultural research in developed and developing countries. International donors and many others see the value of agricultural research networks but want to know what are the elements for success, and the hazards to be avoided.

Definition

A general definition of agricultural networks is difficult because of their diversity of purposes, forms, and operations. A simple definition that takes in all forms of agricultural networks is as follows (Faris 1991):

A Collaborative Agricultural Research Network (CARNET) is a group of individuals or institutions linked together because of commitment to collaborate in solving a common agricultural problem or a set of problems and to use existing resources more effectively.

Objectives

The following network objectives were developed by a group of network coordinators in Nairobi, Kenya in 1988 (Faris and Ker 1988) to:

- Strengthen the applied research capability of National Agricultural Research Systems (NARSs) to identify, address, and solve farmers' problems;
- Generate appropriate technology by using existing research personnel, facilities, and other resources more effectively;
- Ensure stability of agricultural production through a responsive research capability; and
- Provide the support, both technical and financial, needed to facilitate the coordination of activities on a regional basis.

Network Types

Networks vary widely and are dynamic, making classification difficult. A standard classification provided by Ralph Cummins Jr. and Calvin Martin (SPAAR 1987a, 1987b) classifies networks into three types:

- Type I – Information Exchange Network facilitates simple exchange of ideas, methodologies, and research results usually through a Coordination Unit.
- Type II – Scientific Consultation Network allows individuals or groups to focus on a common problem, conduct their research independently, and share their results at common meetings.
- Type III – Collaborative Research Network provides joint planning and monitoring of a common research problem, and it includes elements of the first two types.

Collaborative research networks can be further subdivided on the basis of their general approach: international nurseries networks; methodology networks (the Asian Rice Farming Systems Network is an example); regional program networks [the SADCC (South African Development Coordination Conference)/ICRISAT program is an example]; and NARS-based networks [the Regional Cooperative Potato Research Program for Central America and the Caribbean (PRECODEPA) is an example].

CARNET components

The components of a successful network are research, coordination, communication, membership, and assets (Faris 1991).

Research is the component around which collaborative agricultural research networks (CARNETs) are organized. This component includes information and literature; research per se, conducted by network members; the products of research, such as new technologies or crop varieties; methods; socioeconomic analyses; and databases and their management. How these activities are dealt with in CARNETs is a key to the merits and weaknesses of networks in strengthening research initiatives.

A strong coordination unit is needed to effectively organize and harmonize network activities. This unit is usually comprised of a coordinator and one or more steering groups that represent the members' needs and wishes, and guide and direct the activities of the coordinator. The coordination unit plays a vital role but represents a major expense associated with networks.

The communications component enables the interchange of information and material through correspondence, telecommunications, visits, meetings, workshops, training, and publications. Many of these activities usually require special funding.

The membership component is the body of a CARNET; members produce and draw on the networks' databases. Members can be scientists or administrators from national and international programs, from developed countries, and from donor groups. In some networks, whole projects, institutions, or NARSs are considered members. All members should feel that the network and its activities are designed for them personally.

Assets of a network include members and the facilities and resources available to its members plus external finances to support its activities. This component derives value from other components and is an integral part of them.

Network structures

Network structures can be represented graphically to show how their components are linked and how they interact, to elucidate their functioning and dynamics, and to suggest elements that encourage success. Depictions or models can also help clarify differences among networks.

A simple wheel-like model is the classical depiction of networks (Faris 1991). The 'hub' represents the coordination unit, which is connected to network 'nodes' through 'spokes' (Fig. 1a). The spokes represent the communication component, and the nodes the membership component. A node may be an individual, a research project, an institute, or a NARS. In a simple information-sharing network, movement can be one-way from the hub to the node, but, for example, in a material-exchange network, movement is two-way. If the network also includes communication directly between nodes, through such devices as workshops, monitoring tours, and correspondence, then the network is seen as having a 'rim' (Fig. 1b). The rim is also part of the communication component. All networks that plan jointly have a rim. In most collaborative agricultural research networks, the nodes are also hubs with spokes to cooperative research units (Fig. 1c).

Other presentations of network structures have been used but none truly represents the dynamic and constantly changing character of networks. Like a living organism, a network is conceived, born, grows, and develops, learning from mistakes and from experiences of similar organisms. The network members form the body of the organism, providing the bulk and muscle power, carrying out network activities. The research component is like the metabolism, yielding life, energy, and products that the blood circulates. The heart and blood vessels, along with the nerves (the coordination component), together form the communication component. The assets component – consisting of national and international facilities and human as well as financial resources – is like food that provides the energy that keeps the whole organism active. The analogy ends there but serves the purpose of illustrating the interdependency of network components. It also illustrates why networks should develop all components together.

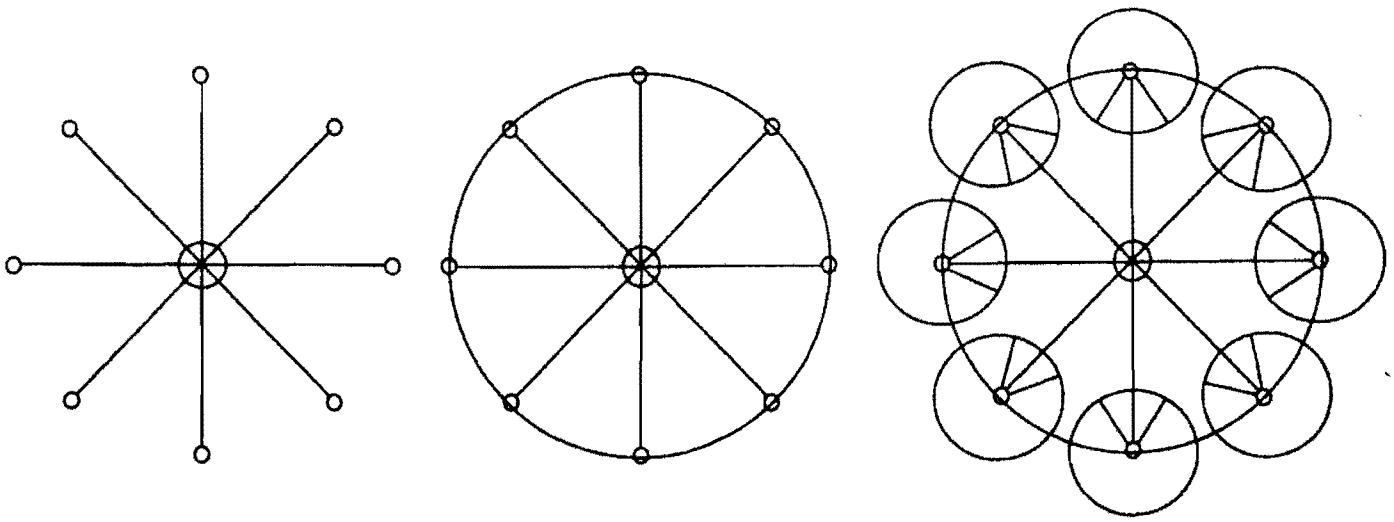

Figure 1. A wheel-like depiction of networks, showing the coordinating hub in the center, the spokes linking the nodes (a), the rim joining the nodes (b), and the nodes forming research units or subnetworks (c).

Costs and Benefits

Networks are not a panacea; there are costs, and there can be problems. From the perspectives of different participants in a network, a benefit to one may be a cost to another.

Networks benefit NARSs both by strengthening the research program associated with the network and by improving members' ability to do research in other programs. In networks, NARS programs become part of the critical mass needed to provide breakthroughs. In general, networks do not build facilities specifically for their activities nor do they employ many permanent staff; thus, they can change research directions easily as new, more important problems are identified by participants. Network activities, such as workshops, give NARS scientists a chance to share ideas and results, interact with international experts, and broaden their outlook.

International Agricultural Research Centers (IARCs) see networks as an ideal means to solidify their partnerships with national scientists, and to channel technology to NARSs for use by farmers. Networks also directly benefit the IARCs' research programs by providing a way to test material under a wide range of conditions and by encouraging feedback from NARSs, national scientists, and farmers.

Donors see networks as an aid in allocating their funds to identified high-priority problems, directing assistance to specific, well-organized targets, and reducing duplication.

The costs of achieving these benefits are not only the expenditure of funds, time, and effort but also the problems and losses that at times result from NARSs involvement in networks. When NARSs participate in networks, they relinquish some control over their research agenda and may even have to dedicate key researchers to work that does not address the NARS's priorities. NARSs should, therefore, carefully consider and choose the networks in which they become involved and not be enticed by donors to join inappropriate networks.

Normally, network research activities are funded by NARSs, either from their operational budgets or from special bilateral projects. In some cases, NARSs do not have adequate funds, and progress of research in the network is hindered. To overcome this problem, donors often set aside small sums for network coordinators to give to network members to ensure continuity in the research.

IARCs normally provide network coordination and scientific backstopping; the costs of these activities are often covered by special funds from donor agencies.

In some cases, networks have fulfilled the role that an IARC would play. For example, in West Africa, networking among francophone countries has received support from France in preference to setting up an international research center in the region, e.g., the Conférence des résponsables africains et français de la recherche agronomique (CORAF) (see Workshop Recommendations.for details).

Traits of Successful Networks

Reasons for success and failure of networks are not always clear. Interpersonal dynamics in a network are complicated, and one person's definition of success may differ markedly from another's. General reviews of networks almost invariably include a consideration of the characteristics of successful ones. Faris (1991) examined the traits identified by 23 authors and classified them by network component (research, coordination, communication, members, and assets) (Table 1).

Networks and global groundnut (*Arachis hypogaea*) research

We would now like to review the role of networks in furthering global groundnut research. Collaborative research activities similar to CARNETs were originally conducted by colonial government research organizations, mostly to improve the production of export crops; groundnut was one of these. Interinstitute and interuniversity collaborative research in many countries are essentially networks. The All India Coordinated Research Project on Oilseeds, supported by the Indian Council of Agricultural Research, is a good example. Groundnut scientists in India meet twice a year to review previous results, identify new research areas, prepare research plans, and allocate responsibilities to appropriate research centers. Similar research coordination can be found in many other countries: the Instituto Nacional de Investigaciones Forestales y Agropecuarias (INIFAP) in Mexico and the Philippine Council for Agriculture and Resources Research and Development (PCARRD) in the Philippines are examples (Faris 1991). Now much of the research on groundnut is conducted in formal or informal networks. Most IARCs and donors such as the United Nations Development Programme (UNDP), the Food and Agriculture Organization of the United Nations (FAO), the United States Agency for International Development

Table 1. Traits of five network components considered important for a successful CARNET (based on the number of times the trait was identified in 23 publications).

Network component	Trait	Times identified
Research	A well-defined common theme or strategy	14
	An important, widely shared objective or problem	10
	An existing or potential source of improved technology (research)	8
	A realistic research agenda	3
Coordination	Strong and effective coordination	13
	A steering committee or advisory group	6
Communication	Education and training	8
	Regular meetings (workshops)	4
	Information-exchange system	4
	Free exchange of results, methods, materials, ideas, and participants	2
Members	Commitment of funds, resources, and staff by NARSs	9
	Strong self-interest served	7
	Capacity to contribute	6
	Participants involved in network management	3
Assets	Flexible outside funding	11

Source: Faris 1991.

(USAID), and the International Development Research Centre (IDRC), Canada, have supported networking to avoid duplication of NARS efforts.

Some other formal groups and networks that address collaborative groundnut research are described below.

Asian Grain Legumes Network (AGLN)

The Asian Grain Legumes Network (AGLN) was established in 1986 to fill a need identified by national programs in Asia. The network facilitates interchange of material, technology, and information on chickpea (*Cicer arietinum*), groundnut, and pigeonpea (*Cajanus cajan*) among scientists in Asia with the aim of assisting farmers in the region increase their production of these legumes.

AGLN's membership includes ICRISAT scientists. It also includes scientists, administrators, and extension specialists in NARS, in regional and international institutions in Asia, and in advanced research institutes in other countries interested in research on AGLN crops. The network has formal collaboration with 11 countries in Asia (Bangladesh, People's Republic of China, India, Indonesia, Myanmar, Nepal, Pakistan, Philippines, Sri Lanka, Thailand, and Vietnam). It works with other countries of Asia when assistance is requested. Presently ICRISAT provides the AGLN Coordination Unit (CU).

AGLN's structure has bilateral and multilateral elements. The bilateral element is built on strong links between ICRISAT and NARS scientists based on formal Memoranda of Understanding (MOUs) between each NARS and ICRISAT, and on collaborative work plans giving details of agreed research and commitments by NARS and ICRISAT. The AGLN country coordinator provides the administrative link with the CU at ICRISAT. AGLN also has bilateral links with donors, and international, regional, and mentor institutions.

The multilateral element is provided by the many network activities that bring AGLN members together, such as coordinators' meetings, workshops, monitoring tours, scientists' meetings, training courses, and working groups.

Conférence des résponsables africains et française de la recherche agronomique (CORAF)

CORAF was organized in 1986 for research and technical cooperation among francophone countries in Africa. CORAF has a series of subnetworks covering maize (*Zea mays*), rice (*Oryza sativa*), cassava (*Mani-*

hot esculenta), groundnut, and drought resistance (Schilling 1988). The main objectives of CORAF subnetworks are to:

- Facilitate the development of African NARS and give them a regional or international dimension;
- Provide the conditions for cooperation among regional and international organizations; and
- Identify high priority research needs, within the terms of each network, for support by international sponsors.

CORAF's groundnut subnetwork assembly has one member from each cooperating country and ICRISAT's Sahelian Center as an observer. The assembly is supported by a full time secretariat for coordination. The network is coordinated by the Institut senegalais de recherches agricoles (ISRA) of Senegal in collaboration with the Institut de recherches pour les huiles et oleagineux (IRHO), France.

The Peanut Collaborative Research Support Program (CRSP)

The Peanut CRSP brings together resources of developing countries and U.S. research institutions aimed at increasing production and utilization of groundnut in developing countries. It is funded through the "Title XII – Famine Prevention and Freedom from Hunger" of the United States Congress, and was implemented on 1 July 1982 (Cummins 1984). The basic objectives are to:

- Conduct research to relieve constraints to groundnut production and utilization,
- Provide short-term and degree-training programs for host country staff,
- Provide consultancy and program support for equipment supplies and travel, and
- Exchange germplasm, and knowledge of production and utilization.

The project involves four U.S. universities (Alabama A&M, Georgia, North Carolina State, and Texas A&M), and nine countries (Thailand, Philippines, Senegal, Mali, Burkina Faso, Niger, Nigeria, Sudan, and Trinidad). Individual projects are designed around priorities and constraints in host countries, but also focus on regional research and development priorities. Information derived from projects is shared with others regionally and globally through reports, publications, meetings, and workshops.

Some examples are co-publication of the *International Arachis Newsletter*, publication of Field diagnosis of groundnut diseases, ICRISAT Information Bulletin no. 36, and support to virus research in the Working Group on Asia-Pacific Groundnut Viruses.

Working Groups

Working Groups are essentially mini-networks formed by a group of specialists committed to work together to address high priority regional problems. Working Groups effectively use experts from advanced laboratories in developing and developed countries. These highly qualified scientists can share components of research that need to be done and can form the critical mass needed to quickly find answers to specific problems. As in networks, working groups use existing staff and facilities to work together at a high level of expertise and avoid duplication. Organization and financial support for these working groups are similar to those for networks.

These working groups resemble the 'Research Consortium' approach of the International Rice Research Institute (IRRI). Those NARSs and institutes that have comparative advantage serve as 'lead centers' or 'satellite centers' to undertake research as agreed in the working group meetings, and share their research findings with others.

Advantages

Organizing Working Groups (WG) to carry out collaborative research within a network like the AGLN have several advantages:

- WGs specialize in tackling and quickly solving high priority problems important to the network members.
- WGs provide a series of discrete entities under the network that can be started and terminated as problems are identified and solved.
- The small size of a WG makes it relatively cheap and easy to get its members together.
- WG meetings can be very productive as they are tightly focused.
- Funding research and training activities within one WG can help support overlapping activities of another group, for example, laboratory and field facilities, travel, training courses, and meetings.
- The main network and its Coordination Unit can

facilitate the WG's activities by providing administrative coordination and logistical support.

- The members of the main network can continuously help to identify problems that need solutions.
- The network organization can be used to quickly disseminate research results and other information to WG members.

Organization

Each WG has a Technical Coordinator (TC) to coordinate the research activities of the group. The TC is identified by the WG members and follows their directions. The TC is an expert in the subject of the WG working at the lead center for the WG topic.

Membership will include scientists from NARSs, international and regional institutes, and laboratories in developed countries who are experts in the topic of the WG.

Logistical coordination is provided by the main network's Coordination Unit.

The following working groups are examples of how the approach can be utilized to find solutions to regional groundnut problems.

Working Group on Groundnut Rosette Disease

Groundnut rosette is the most important groundnut virus disease in Africa. It often occurs in epidemic proportions and causes millions of dollars of crop loss. Since the first report of its occurrence in 1905, research on rosette has been restricted to distinguishing various types of rosette, transmission by aphids (*Aphis craccivora*), and management of the disease culturally and by insecticide application.

Resistance to rosette was identified in groundnut landraces from Côte d'Ivoire and Burkina Faso, and used in breeding programs in Senegal, Nigeria, and Malawi. These cultivars have maintained their resistance for over 25 years.

Despite the progress made on managing rosette disease, very little was known about the causal viruses prior to 1983. To detect and characterize the virus, access to advanced technology was essential. It was apparent that this research would have to be done in a country where groundnuts are not grown but where good virology research facilities were available. Thus cooperative links were established in 1981 with virologists in the Institute for Plant Protection in Brunswick (BBA), West Germany, and in 1983 with the Scottish Crop Research Institute (SCRI), Invergowrie, UK. The Peanut CRSP initiated a project on identification of groundnut viruses in West Africa in 1982. The Peanut CRSP organized the first meeting among these groups to discuss coordination of research on rosette disease. Despite significant progress as a result of this meeting there was still the need for more coordination. Therefore, ICRISAT organized a second meeting of the Working Group in the UK in 1985. All the research groups involved including African NARSs were present. ICRISAT and the Peanut CRSP were given the responsibility of technical coordination and each group was given a specific aspect of the problem related to rosette.

The Working Group met again in 1987 (ICRISAT 1988a) and in 1990, when the Group's scope was widened to include other economically important groundnut viruses and the membership was increased to include more African NARSs. The efforts of this Working Group has resulted in substantial progress on the causal viruses of rosette disease, providing the technology to answer farmers problems.

It was found that a satellite RNA, which depends on groundnut rosette virus (GRV) RNA caused the symptoms of rosette disease. GRV can replicate in groundnut plants without the production of overt symptoms. Both GRV and the satellite depend on the packaging of their RNA in the coat protein of a second virus, the groundnut rosette assistor virus (GRAV) for transmission by the aphid vector. Thus, for spread of groundnut rosette disease all three agents (GRAV, GRV, and its satellite) are necessary. Attacking any one or all of them should provide a means to control the disease. As a result of these findings it is now possible to study components and mechanisms of resistance.

Asia-Pacific Working Group on Groundnut Viruses

This Working Group started as the peanut stripe virus (PStV) working group in 1987. Peanut stripe is an important disease in the People's Republic of China, Indonesia, the Philippines, Malaysia, and Thailand, and has become established in the USA. Its appearance and establishment as a major disease in the USA through seed imported from the People's Republic of China underscores its significant threat to other groundnut growing countries. A PStV researchers consultative meeting was organized by AGLN/ICRISAT [in collaboration with the Australian Centre for International Agricultural Research (ACIAR), the Peanut CRSP, and AARD, Indonesia] in Indonesia in

1987 (ICRISAT 1988b). The objective was to bring together all information on the disease, review research, identify future needs, and prepare a plan of action to manage the disease. Twenty participants from eight countries, ACIAR, FAO, and the Peanut CRSP participated. Nomenclature of the disease, which was earlier confused with peanut mottle, was clarified and agreed upon. Participants recommended that future research should be coordinated by AGLN, and identified scientists in each country to lead PStV research. Salient features of research conducted by the working group are:

- Publication of the nomenclature of the disease to avoid confusion.
- About 10 000 groundnut germplasm lines, wild *Arachis* species, and interspecific derivatives have been screened under field conditions in Indonesia. None of the germplasm shows resistance. A few tolerant, late infection lines have been identified, some of which are interspecific cross derivatives. *Arachis duranensis* was found to be resistant. Some lines have low seed transmission.
- A Thai scientist with support from IDRC worked at Montpellier, France, to characterize the isolates of PStV and prepare antisera for their identification.
- Studies in Indonesia have indicated that yield losses due to PStV are 40–50% if infection occurs early in the crop growth, 1–3 weeks after emergence, especially in the dry season.
- Two regional training courses at Malang, Indonesia, and ICRISAT and one in-country course in the People's Republic of China have been conducted to teach methods for identifying PStV and other groundnut viruses.
- A second consultative group meeting was held at ICRISAT Center in August 1991 to review results since the 1987 meeting and plan future research (ICRISAT 1989). The participants made several recommendations with regard to detection and identification of viruses (seed movement and quarantine); epidemiology (vectors, transmission, yield-loss studies, and surveys); groundnut viruses and their control; and regional activities. They also decided to expand the group to include several scientists working outside the region, and renamed the group the "Working Group on Asia-Pacific Groundnut Viruses". The AGLN was asked to continue coordination for the working group.

The establishment of this working group has helped focus attention on PStV and other viruses and ensure that support is provided for research.

Working Group on Bacterial Wilt (*Pseudomonas solanacearum*) of Groundnut

Bacterial wilt of groundnut caused by *Pseudomonas solanacearum* is a major disease in the People's Republic of China, Indonesia, Malaysia, the Philippines, and Thailand in Asia, and in Uganda in Africa. Yield losses are reported to vary from 20–50% depending on the incidence and occurrence of the disease. Research efforts have been isolated and discontinuous. Most results from the People's Republic of China were not available to others; and Chinese scientists could not interact with other scientists. A joint ACIAR/ICRISAT Collaborative Research Planning Meeting on Bacterial Wilt of Groundnut was held in Mar 1990 in Malaysia. Twenty-nine scientists from Australia, the People's Republic of China, Indonesia, Malaysia, Nepal, Philippines, Sri Lanka, Thailand, the UK, the USA, ACIAR, the Asian Vegetable Research and Development Center (AVRDC), and ICRISAT participated (Middleton and Hayward 1990). Following a review of past results the participants recommended coordination of research on bacterial wilt, and listed the following lines of research: characterization of *Pseudomonas solanacearum*, host range and strain differentiation, epidemiology and survival, detection of latent infection and seed transmission, and host plant resistance. AGLN/ICRISAT was requested to be Administrative Coordinator, and Dr A.C. Hayward, University of Queensland, Australia was nominated as the Technical Coordinator.

Working Group on Integrated Pest Management (IPM) and Insecticide Resistance Management (IRM) in Legume Crops in Asia

This working group addresses IPM and IRM for legumes, especially chickpea, pigeonpea, and groundnut in Asia. Legume crops are particularly susceptible to a wide range of pests. Injudicious use of pesticides often leads to massive pest resurgences that are attributed to disruption of natural control processes and the development of insecticide resistance. Yet alternative strategies to total reliance on insecticides do exist. Some of these strategies may not be fully understood by all plant protectionists in the region. This working group was, therefore, mooted to allow exchange of information, coordinate research, and help those con-

cerned with IPM in legume crops to focus on the requirements of farmers. A consultative group meeting of representatives of NARSs, IARCs, the agrochemical industry, and the commercial grain legume growing sector was held in March 1991 in Thailand (ICRISAT 1991). The participants agreed to form a subnetwork (working group) to support IPM and IRM, and disseminate information.

Other Working Groups

Apart from those described above, there are other research areas that are of regional interest. The following are potential working groups for groundnut in the future:

- Acid soil tolerance Working Group,
- Working group on Aflatoxin contamination in groundnut,
- Working group on stem rot/pod rot in groundnut,
- Working group on agroclimatology of AGLN crops in Asia,
- Nematology working group,
- Drought resistance working group,
- Working group on nitrogen nutrition of legumes,
- Working group on utilization of legumes, and
- Working group on small equipment for groundnut production.

These could be initiated as and when enough scientists and/or institutions show interest and are willing to pool staff, expertise, and resources to tackle the issues in a coordinated manner.

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