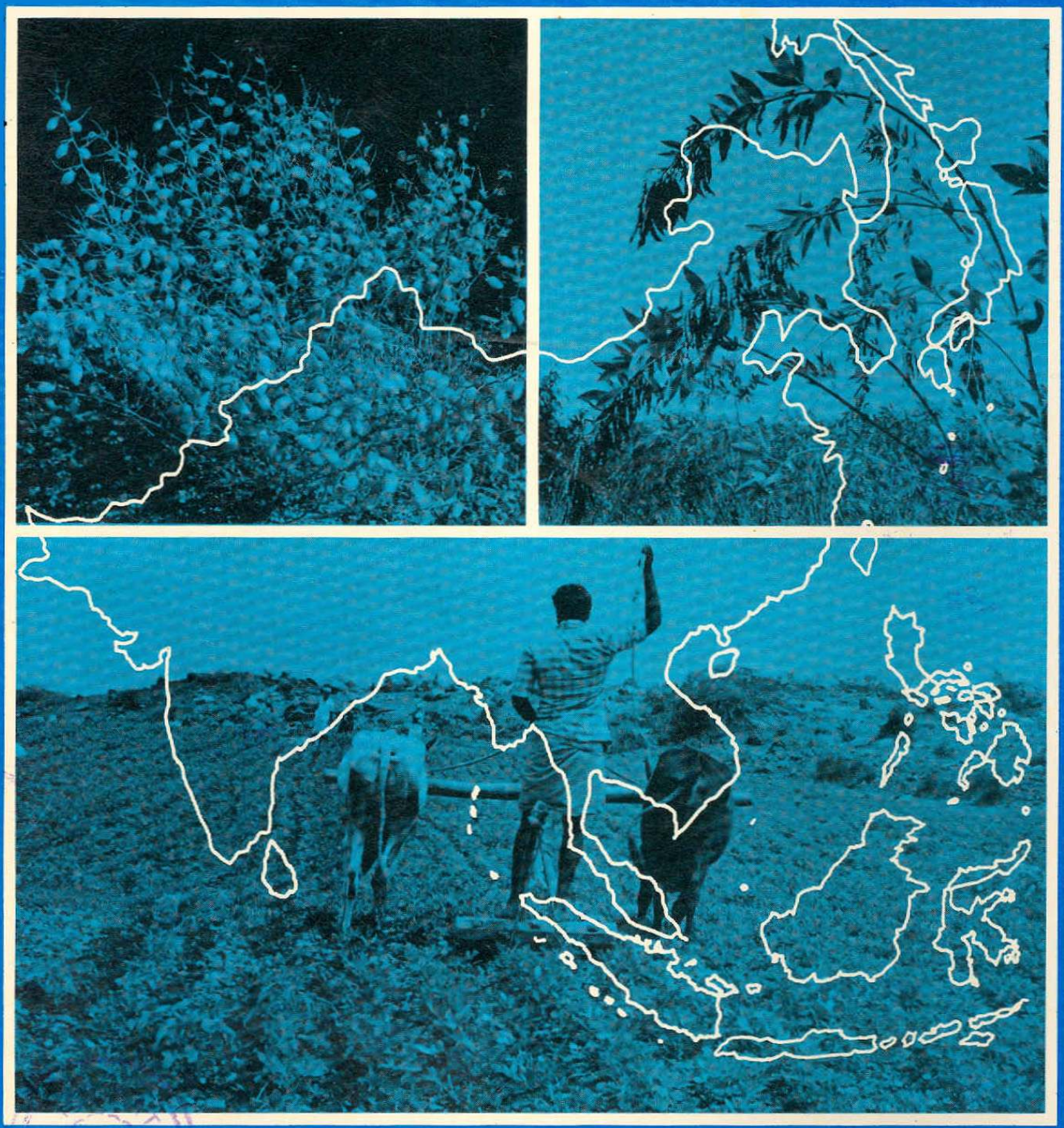
Enhancing Grain Legumes Research in Asia



International Crops Research Institute for the Semi-Arid Tropics

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The activities of the Asian Grain Legumes Network (AGLN) coordinated by the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) are reviewed. The progress made by the network in collaborative activities involving groundnut, chickpea, and pigeonpea since the last meeting in Dec 1988 is examined. The past, present, and future role of networks in AGLN countries is presented along with suggestions for strengthening collaboration. The opportunities for collaboration between AGLN and other groups interested in research in Asia are reported. Ways to enhance collaborative research on AGLN crops and other network activities are recommended.

Background Information on the AGLN

The Asian Grain Legumes Network (AGLN) was established in 1986 to facilitate the interchange of material information, and technology between the grain legume scientists at ICRISAT and in Asian countries. The objective of the network is to enhance research infrastructure, with the ultimate aim of helping farmers to increase legume production in Asia. It is a network of scientists who have indicated their commitment and willingness to work together to solve the production constraints in chickpea, pigeonpea, and groundnut in Asia. ICRISAT has provided the Coordination Unit to facilitate the network's activities. Presently, the network activities are in Bangladesh, People's Republic of China, India, Indonesia, Myanmar, Nepal, Pakistan, Philippines, Sri Lanka, Thailand, and Vietnam.

Enhancing Grain Legumes Research in Asia

Summary Proceedings of the Asian Grain Legumes Network Coordinators' Meeting

10-12 Dec 1990, ICRISAT Center, India

Edited by
D.G. Faris and O.P. Rupela

ICRISAT
International Crops Research Institute for the Semi-Arid Tropics
Patancheru, Andhra Pradesh 502 324, India

Asian Grain Legumes Network Coordinators' Meeting

Objectives

A G L N coordinators met to review the progress of the Asian Grain Legumes Network (A G L N) since the meeting of Coordinators at ICRISAT in Dec 1988 and to provide guidance and direction for the A G L N's future activities. The meeting did this by:

- reviewing activities associated with the network
- examining usefulness and ways to improve subnetworks and working groups for solving regional problems
- suggesting improvements: in exchange of genetic material, information, and technology; in training; in support of research; and in linkages with other regional research and donor groups
- drawing up plans to provide the greatest impact possible by A G L N on legumes production in Asia
- discussing disbursement of A G L N funds

Representatives from donor, regional research groups, and other countries attended as observers and provided information where necessary-

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O.P. Rupela
S.N. Silim
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O.P. Rupela
S.N. Silim
Other groups
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E. Kueneman

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OPENING SESSION

Welcome and Meeting Overview

D. McDonald

Legumes Program, ICRISAT

On behalf of ICRISAT's Management and the Legumes Program I welcome you to this second meeting of Asian Grain Legumes Network (AGLN) Coordinators. It is also our second attempt at getting you here, and we are very pleased indeed that it has been successful. We are all very grateful to delegates for arranging to attend this meeting, and we apologize for the inconvenience caused by the last minute cancellation of the original meeting in Nov.

The last Coordinators' Meeting was held in Dec 1988, and since that time Vietnam has joined the network. ICRISAT has recently signed memorandae of understanding (MOU) with several other countries who have interest in cooperative research in the. region, including Iran and the USSR.

The AGLN is a group of scientists in Asia interested in collaborative research on chick-pea, pigeonpea, and groundnut, and on cropping technology associated with these crops. ICRISAT provides the Coordination Unit for the network whose main task is to facilitate direct interaction among AGLN scientists. ICRISAT also helps in scientific and material backstopping, including human resource development. Each AGLN country has a formal bilateral connection with ICRISAT so that a work plan can be tailored to meet its needs. Meetings such as this one provide for high level interaction among network countries. Since the last meeting, working groups to address specific problems have become a more important feature of the AGLN. The overall purpose of this meeting is to review the activities of the past two years, and to provide guidance for the future direction of the network.

During this opening session Dr Swindale will review ICRISAT's strategy in relation to Asia, and the AGLN Coordinator will give a report on the most important activities of the network since the last meeting indicating how the recommendations of that meeting have been implemented.

In subsequent sessions ICRISAT scientists will describe recent research in their fields of interest as related to Asia, the Country-AGLN Coordinators will give their ideas on the past, present, and future role of AGLN in their respective countries, and the representatives of regional development organizations will tell us about the opportunities they see for collaboration with the AGLN.

We have provided opportunities for you to discuss ways to improve AGLN activities and develop recommendations and plans for future activities in the network.

I want to thank the Asian Development Bank (ADB) for providing the funding for this meeting and for supporting activities of the network. The United Nations Development Programme (UNDP) has also provided funding for the Asian Grain Legumes On-farm Research (AGLOR) program associated with the network. The Food and Agriculture Organization (FAQ), Australian Centre for International Agricultural Research (ACIAR), International Development Research Centre (IDRC), and many other regional development institutions have provided important support to the program.

Thank you all for coming. I am looking forward to an exciting and productive meeting.

ICRISAT's Strategy and the AGLN

L.D. Swindale

Director General, ICRISAT

Dr. Swindale welcomed the AGLN Country-Coordinators to ICRISAT and apologized for the disruption caused by the problems in Hyderabad[1]. He suggested that it is time for the AGLN Coordinators to consider possible changes in the network's role. He urged them to help Asian countries be more aware of ICRISAT material available through the AGLN and the use they can make of the results to help them to achieve improvements for their farmers. As a measure of its success he asked the coordinators to compare the progress that had been made in passing on information before and after the AGLN was established and the amount of plant material of AGLN crops that has been released to farmers. He pointed out that the activities of the AGLN have been made possible through ICRISAT's core budget provided by Consultative Group on International Agricultural Research (CGIAR) donors and through special project budgets from donors such as ADB and UNDP.

AGLN has undertaken several new activities since the last coordinator's meeting including in-country training programs involving national programs, ICRISAT, and other regional staff, and cooperative research subnetworks or working groups to solve high priority regional problems. As well as involving the National Agricultural Research Systems (NARSs) represented here the working groups have involved other regional institutes, scientists and laboratories from developed countries. India has had a special role in providing consultants for network activities.

1. Editor's note. Disturbances in Hyderabad during the meeting prevented regular movements of ICRISAT staff transport, so the program itself was adjusted to staff movements. Dr Swindale's talk was rescheduled to coincide with his delayed arrival at the Center, and as a consequence, the first part of his talk was not recorded. This part of his talk has been partially reconstructed from notes made by participants, and the remaining part has been transcribed.

The NARSs in Asia, represented here by many of the country coordinators, are well organized and financed when compared to many NARSs in the world. For example, the NARS of one African country still receives 90% of its funds from outside the country and is almost fully dependent on expatriate scientists for its research.

In Asia it was possible when establishing the AGLN to work with the administrative and scientific leadership of the national systems and develop memorandae of understanding which ensured their commitment to the programs that we do together. That commitment is related to the fact that the administrators are largely responsible for assigning the funds that you people use and, if they are not interested in what you are doing, you do not get the funds. So they must know what AGLN is about; they must agree to its purposes, to its projects. We must have this clearly expressed in writing so that all of us know where we stand. Thus, subsequent to signing these MOU, we have developed work plans with most countries lasting for one, two, three years or more. Those work plans are intended to detail the way in which we work with you and your colleagues; what you expect of us and what we expect of you. Dr Faris and his colleagues have gone to a lot of trouble to ensure that we have these two levels of agreements with virtually every country represented here today - a MOU and an annual work plan. I am pleased to say that under the guidance and example of AGLN in the last couple of years we have worked out similar work plans with India.

It is important that we work out with each of you a proper measure of cooperation keeping in mind that viewed from the perspective of some of the national programs represented in this room, ICRISAT is very small. We are not a large organization, particularly when we think about trying to serve the needs of the millions of farmers who live in Asia, and whom you as leaders of your national programs have to serve. The simple fact is that ICRISAT does not have enough resources to serve all of you to the extent desirable. We have therefore tried to work out a balanced program. Don Faris is an optimist; so he always hopes that we can do more than we really can. He is always anxious to serve but he recognizes that when we place this set of our work plans before you, they must add up to something that is within our capacities. I think that he and his colleagues have done a good job in ensuring that they are at least possible if not immediately attainable. Another important thing about them is that they allow us all to be accountable. We are dealing in Asia with national research systems that are doing good work by themselves. We are working in the spirit of equality and mutual respect and in that spirit, we have the right to hold each other accountable for what we agree to do together. That is the proper relationship amongst confident and equal partners.

I have also been pleased that AGLN has stimulated new activities in adaptive research such as the AGLOR program involving Sri Lanka, Nepal, Indonesia, and Vietnam along with ICRISAT, supported and assisted by FAO and UNDR We believe that it is an important program and hope that you will have an opportunity during this meeting to discuss it in some detail. I do not want to divert the main purpose of your meeting to the discussion of the AGLOR program but I hope that it can be discussed.

We have been able to assist India in recent years with adaptive research to increase the production and productivity in all its legume crops. Dr. Shenoi wearing a different hat and traveling a different road was very much part of that program, and its leader. We know that

was useful for this country. We know that those types of activities which provide a big push towards adaptive research and extension are necessary from time to time in order to provide the stimulus to this very large unyielding body called agriculture. We hope that a similar impetus can be given to help other countries in Asia, The on-farm trials seem to be working in Sri Lanka at the present time. These trials let you see on the ground whether or not the new technologies are really working and whether they are really going to move things; if not, we need to decide what to do next.

ICRISAT recently undertook to study a new strategic plan for the next 10 years. The plan calls for the continuation of the AGLN and basically, of its present methods of working. It calls on us to participate more in national research planning meetings dealing with all mandate crops. We invite you to tell us whether you, in each of your individual countries, would like us to do so. It suggests that we should increase the use of Information Services to provide more scientific literature under Semi-Arid Tropical Crops Information Service (SATCRIS). I hope that you have found SATCRIS useful and that you will learn more about what it has to offer. The plan suggests that we develop activities with sorghum, a cereal used in the rest of Asia mostly for foodgrains and fodder, and that we develop activities for that crop in Asia similar to those we have developed for legumes in AGLN. Eventually, if this works out, we may consider the possibility of merging the cereal and legumes network programs into one. We hope in the next decade to increase our research efforts for the benefit of farmers in Asia.

We realize more than most of our donors, particularly more than our European donors, how fast Asia is growing both in terms of population and in terms of economics. We understand how much Asia will move over the next decade away from goals of self-sufficiency towards goals of self-reliance. That is to exploit the natural comparative advantages that you have in each of your countries and participate in more international, and regional agricultural trade. We are hopeful that we will get the funds needed to increase our activities in Asia in the next few years. ICRISAT is certainly not willing to divert resources designated for research in Africa to increase such activities for Asia; that will not be appropriate.

In September this year we finalized a very intensive in-depth external review of ICRISATs research and management. Overall, the report gives us good marks and makes several recommendations for the future, some of which directly impact upon the AGLN. It recommends very strongly that we should move towards more strategic research. We should not be producing too many finished varieties, except for specific purposes and for certain countries but rather concentrate on producing improved germplasm with specific adaptations. It recommends that we limit our crop improvement programs in legumes to the three that are currently within our mandate. That does not mean the report is not in favor of work being done on other legumes. Of course not. It hopes that other agencies will step in and take up the work that is being currently done by ICRISAT to help national programs of the region. It recommends that we do not include a program on integrated pest management under the umbrella of AGLN. Again, it is not proposing that we do not undertake such a program; it feels that AGLN has a lot on its plate already and should not try to add such a program to its agenda.

There is no doubt in my mind or in the thinking of the Board that ICRISAT and its donors will continue to support AGLN. I hope that there can be some shift in emphasis and some reduction in activities; that we devote more resources to coordination. In particular, I suggest that these cooperative research networks - subnetworks, I think you call them in the AGLN - should be coordinated by some of you, by national programs. Strong national programs should step forward in the spirit of regional assistance and technical cooperation among developing countries, and offer to act for you as coordinators of those cooperative research networks. They are strong enough to do it; there is no reason why they should not. It is a matter of whether you see yourselves entirely living within your own sovereign boundaries or whether you believe that there are benefits in reaching out to the rest of the region. I have no doubt that the latter is true.

ICRISAT will not undertake work to coordinate research and information with respect to other legumes. We know that some of you asked for that. But we do hope that others will come forward to help do that. I think that FAO in its regional office has the organizational support and the capacity to do this; so does Economic and Social Commission for Asia and the Pacific (ESCAP) in some of the regional organizations that it supports. And again perhaps one or another of you would like to offer to undertake this work on behalf of all the nations in the region.

At this time I would like to take the opportunity to welcome representatives of Asian Vegetable Research and Development Center (AVRDC), Bean/Cowpea-CRSP (Collaborative Research Support Program) of US universities, and other agencies that deal with legumes. I am pleased that they are here at this meeting; I hope that they will offer their services for the legumes for which they are responsible, and discuss with you now if one single overall organization is needed to promote research on all legumes.

Last week we had a meeting here on what types of research ICRISAT should involve itself in the field of biotechnology. Dr Moss and others will be able to describe the recommendations resulting from that meeting. But clearly this is an area that ICRISAT will involve itself in the future. If biotechnology does not get additional resources it may be at the expense of the resources which we currently apply to coordinating activities.

Finally, because Asian countries are developing so well we know that some activities on the national agricultural research agenda are now being taken up by the private sector. This is certainly true in India. And that is to the benefit of crop research. But this means additional resources are being applied to agricultural research and that a strong effort is being made to connect research with extension and utilization. We imagine that this is true in other countries as well. ICRISAT, according to its rules, must make its results and information freely available to all genuine users. To us that includes the private sector. I wonder if the time is yet ripe for AGLN to start thinking about how it might cooperate with the private sector and research agencies in your countries.

I think you have much to do in the next few days and I do not want to take any more of your time. I hope that the problems in Hyderabad do not inconvenience you very much and that your work will go forward smoothly. I am sure that your meeting will be interesting.

AGLN Coordinator's Report

D.G.Faris

Legumes Program, ICRISAT

The duties of the AGLN Coordinator within the network is to act as its Executive Secretary and carry out the directives of the network's Steering Committee. As this Coordinators[9] Meeting forms the AGLN Steering Committee, I am responsible to you. Thus I come before you with this report. The report will be in three parts: actions on recommendations of the last meeting in Dec 1988, activities since the last meeting, and suggestions for the future.

Actions on Recommendations

- The AGLN has remained a high-priority activity for ICRISAT and has become accepted as ICRISAT's outreach for legumes into Asia. As you will learn, the AGLN Coordination Unit (CU) has helped to facilitate and coordinate many activities, even some outside the Legumes Program at ICRISAT The network has played an important role in stimulating ICRISAT scientists to understand production constraints in Asian countries and direct their research to answer these constraints. The AGLN has also attracted over $1.5 million to support activities with which it is associated. Your task as coordinators will be to advise how best to use these funds within the guidelines for disbursing grants.
- I have reevaluated the objectives of the network as recommended and have prepared a draft detailing the purpose and objectives of AGLN for your consideration during this meeting (Appendix 1), Objectives already attained, like producing a directory of AGLN cooperators have been removed, and new initiatives added.
- This Coordinators' Meeting has resulted from the recommendation to form a Steering Committee. It has come now because funds became available for this activity with the new ADB/AGLN grant. We are all very appreciative of the ADB for their assistance. You will need to decide if you want such a meeting every year (which will use up all funds allotted for meetings in the ADB grant) or whether you would prefer appointing perhaps six representatives for a steering committee to meet every year. Another possibility is to appoint an executive committee of three or four people to meet more frequently and have all coordinators meet every two or three years. It should be remembered that the in-country AGLN review and planning meetings already provide an ideal means to interact with the AGLN CU to update your individual requirements.
- The recommendation to provide training opportunities has resulted in 93 candidates studying legume crops at ICRISAT during 1989 and 1990 for the equivalent of 37 years. Of these, 32 candidates from India spent the equivalent of 10 years and 61 candidates from other Asian countries spent the equivalent of 27 years. In addition, during 1989 and 1990 there were five in-country courses in Bangladesh, Myanmar, Nepal, Sri Lanka,

and the People's Republic of China. These courses involved a total of 34 in-country faculty members.

- Following the recommendation to implement a program to train the trainers, the Course Principal in three in-country AGLN courses was a local scientist Again, in the virus identification course in China, a local scientist who had received training from ICRISAT, played a major role in conducting the course.
- As recommended, information about SATCRIS and the services available from the ICRISAT Library was sent to all AGLN Coordinators. The response has been good but not overwhelming (Table 1).

Table 1. Number of legume crop users in Asia of ICRISAT's library services.

Service	Asia (excluding India)	India	Total
On-line SATCRIS search	5	152	157
SATCRIS abstract service	25	160	185
Crop abstracts	93	170	263
Total	123	482	605

- In response to the recommendation that AGLN facilitate links with institutions working on legume crops other than chickpea, pigeonpea, and groundnut, the AGLN CU collaborated with ACIAR and IDRC in developing a proposal for a regional Food Legume Asian Steering Committee (FLASC) (Appendix 2). Both ACIAR and IDRC are unable to support FLASC at this time, so the AGLN Coordinator presented this proposal to the FAO/RAS/89/040 Food Legumes and Coarse Grains (FLCG) Network Regional Coordination Council Meeting, RCCM 1, at Beijing in Jun 1990 for their support. They in turn recommended that the Asia-Pacific Association of Agricultural Research Institutions (APAARI) sponsor FLASC.

The AGLN has also strengthened its links with other regional and international organizations working on AGLN crops.

Activities in 1989 and 1990

In conjunction with this report I have prepared a "Summary of Activities Associated with the Asian Grain Legumes Network 1989 and 1990." This Summary has been published in 1990 as the Asian Grain Legumes Network: AGLN Cooperators Report No.2. It shows that during 1989 and 1990, ICRISAT provided strong scientific backstopping to the AGLN, This backstopping has resulted in a total of 30 varieties of chickpea, pigeonpea, and groundnut based on ICRISAT material being released in Asia in recent years.The Summary also shows that 675 trials, and over 5000 breeding lines and 20 000 germplasm lines

were distributed from ICRISAT to Asia in 1989 and 1990. ICRISAT scientists provided backstopping to AGLN national programs by making 86 trips spending a total of the equivalent of about 3.8 years in AGLN countries during 1989 and 1990. During these visits they assessed disease, insect, and other problems, discussed ways to overcome them, and developed collaborative research plans.

I want to thank you as Country-AGLN Coordinators for the strong support you have given to the CU; this despite the fact that several of you are new to the job. I think it is a good indication of the strength of the AGLN that it has continued to function well in all countries, even where there is new staff. During these 2 years mechanisms have been identified in all 11 AGLN countries for the movement of funds so that they can be used directly by the AGLN group in each country. Several have yet to be tested. The ability to readily move funds becomes important with the grants provided to AGLN by ADB and UNDP/FAO.

Working groups associated with the AGLN have become more important over the last 2 years. Two years ago I gave a detailed report of the wide-ranging and effective activities of the Peanut Stripe Virus Working Group following its first meeting. Their work has continued. Finding no good genetic resistance after screening over 9000 germplasm accessions, they have shifted to developing effective cultural control, combining lines with partial resistance, and identifying lines with low seed transmission of the virus. The group held a second workshop which identified basic studies needed on this virus. They have also expanded their interest to cover all groundnut viruses in the Asia-Pacific region. I list below the working groups with which the AGLN is associated or which are being considered.

Working groups:

- Asia-Pacific groundnut viruses (formerly the Peanut Stripe Virus Working Group)
- Bacterial wilt of groundnut (with ACIAR)
- Host selection behavior of Helicoverpa armigera

Potential working groups:

- Botrytis gray mold of chickpea
- Screening for acid soil tolerance (coordinated by Peanut CRSP)
- Ascochyta blight of chickpea (coordinated by ICARDA)
- Integrated pest management in legumes
- Biotechnology in Asia
- Groundnut germplasm network (with IBPGR)
- Quality testing in legumes
- Agroclimatology in AGLN countries

This list is not complete and your help is needed to identify high priority problems for which working groups should be organized.

The AGLN has facilitated contact among AGLN scientists by supporting travel of members to appropriate workshops, to other countries, and to ICRISAT. Five workshops were held. A total of 242 NARS travelers from 16 Asian countries made 112 trips in association with the AGLN for a total of about 168 weeks.

The activities on human resource development (training) have been covered in the "Action on Recommendations" section. This continues to be an important component of the network-

A new project associated with the AGLN since our last meeting is the Sri Lanka Pigeonpea Production Project. It is a country project funded by ADB starting in Aug 1989. This project has a very good chance of being very successful for the following reasons:

- Sri Lanka imports each year around $40 million worth of lentils as it is the preferred pulse; this import is necessary as Sri Lanka cannot successfully grow lentils
- Pigeonpea dhal has been identified as a substitute for lentil dhal acceptable to consumers in Sri Lanka
- The new short-duration pigeonpea varieties are well adapted to Sri Lanka's strongly bimodal rainfall conditions, especially for the production of at least one ratoon crop
- Effective control methods for the insect pests on pigeonpea have been identified and proven on-farm
- The pigeonpea crop was earlier devastated by insects resulting in the failure of the crop; another reason for the failure of the short-duration pigeonpea cultivars was lack of a ready market
- A vigorous program to identify appropriate technology and machinery for manufactur- been undertaken
- Varieties and technology are being tested and demonstrated to farmers on a large scale, and farmers appear excited at the prospect of cultivating this crop
- A strong research program on pigeonpea is being established in Sri Lanka to backstop this program
- The administration in the various ministries and the scientists involved are supporting this program fully
- ADB has provided adequate support and has allowed full flexibility to develop the program as considered best by the participants

This project is an example of a program which has all the elements for it to succeed. When we consider new projects for the network, we should see that they contain elements that have enabled this project to succeed.

Also new in AGLN since the last meeting is an increased emphasis on ensuring that new technology is appropriate for use by farmers, and on encouraging its acceptance and dissemination among them. In India, the Legume On-Farm Testing and Nurseries (LEGOFTEN) operation has been associated with the AGLN and for certain AGLN countries (Indonesia, Nepal, Sri Lanka, and Vietnam), the Asian Grain Legumes On-farm (AGLO) Research Planning Meeting was held at ICRISAT in Nov 1989.

Following this meeting the UNDP has provided funds as part of FAO / RAS / 89 / 040 to support AGLOR in those four countries. The planning session for Indonesia was held 29-30 Nov 1990 in Malang and now this week, site characterization in Indonesia is being done with assistance from International Rice Research Institute (IRRI) staff. In addition, the new ADB - AGLN Project has provided funding and is encouraging this type of activity in all AGLN countries. Both donors strongly feel that the impact of research in the network

can only be realized when farmers use and accept research findings and this acceptance becomes widespread.

This coverage of activities associated with AGLN is not complete but gives an indication of what has happened.

Future Direction and Plans

For the AGLN's future I have suggestions that fit the general guidelines of the network along with how and by whom they could be implemented. The feasibility of doing these will need to be considered after they have been assigned priorities.

Collaboration. Collaborative research between NARSs and ICRISAT should continue to receive high priority. You may wish to suggest ways that this might be modified.

ICRISAT multidisciplinary teams have spent considerable time in your countries assessing your constraints to production, making suggestions, and developing collaborative research projects with you, ICRISAT scientists have adjusted their own research programs to be better able to collaborate with you. In the future, the number of ICRISAT scientists traveling together can be fewer. There should be at least one contact between each country and ICRISAT scientists each year to review and update work plans. Each additional visit will need to have clear justification.

Scientists' meets. Feedback suggests that there should be more scientists' meetings at ICRISAT to allow scientists to choose germplasm appropriate to their needs and to have a chance to discuss their needs with ICRISAT scientists. You may wish for instance to have certain parents included in the ICRISAT crossing program or have your own material included in the international trials and nurseries.

AGLOR. On-farm adaptive research to identify appropriate and acceptable technology and ways of getting farmers to adopt this technology will continue. The CU needs feedback as to whether emphasis should increase or decrease.

Working groups. As an important component of the network's research, specialized working groups are expected to increase. We will be looking for your feedback as to what new problems need attention.

Review and planning meetings. The in-country review and planning meetings have helped identify each country's research needs and ways to meet these needs. We are suggesting a full review and planning meeting in each country no more than once every second year. There should still be scientist-to-scientist interactions between meetings where plans can be suitably modified. We need to assess the value of these meetings and how they might be improved in terms of timing, content, number of participants, and inclusion of a monitoring tour.

Human resource development (HRD). The HRD component of activities associated

with the AGLN should be planned so that they provide scientists with the knowledge they need to make the best possible contribution to the network's research- Thus courses must be designed to meet the specific needs of the network. Some suggestions include courses on crop protection, mechanisms of host plant resistance, research station management, manufacture and use of small Rhizobium fermenters, use of MSTAT software, and report preparation. These and other suggestions should be considered as part of the work plan for each country

Workshops. Workshops and other inter-country meetings allow interactions among AGLN countries. They also provide a means for sharing and passing on valuable technical information needed to keep research up-to-date. The following are some of the workshops being planned at ICRISAT. Your comments would be welcome.

Second International Groundnut Workshop, 25-30 Nov 1991
Groundnut Modeling Workshop, 28-30 Nov 1991
Second International Pigeonpea Workshop, 1992

Special initiatives. Some possible new initiatives which can be considered for work plans are briefly described.

Small farm equipment. We receive many requests for information about small farm equipment, particularly those that help implement new technologies. Examples are groundnut diggers, strippers, and shellers, and raised bed-makers. A wide variety of appropriate equipment already exist, including equipment farmers have developed themselves/Many farm equipment networks already exist and catalogs are available. There is need to access this information and make it available to AGLN cooperators to pass on to farmers. Equipment needs to be tested to compare its usefulness for use with AGLN crops. The Asian Rice Farming Systems Network (ARFSN) has recommended that AGLN be responsible for upland crop equipment. For these reasons we expect to appoint a person at ICRISAT to identify equipment and start a database. You may wish to organize a Small Farm Equipment Working Group and identify some person or group to coordinate its activities.

Newsletters. The AGLN has relied on the International Chickpea, Pigeonpea, and Arachis Newsletters to disseminate new technical information on AGLN crops and the AGLN Cooperators' Report to list AGLN activities. In addition, many AGLN members receive the Food Legume and Coarse Grain Newsletter (FLCGN), the ACIAR Food Legumes Newsletter, and Palawija News. Inspite of these, the AGLN may need a newsletter for quick dissemination of information on training, materials available, upcoming activities, and information about AGLN in-country research activities and results.

New project proposals. ICRISAT has agreed to assist Bangladesh look at the needs for research in the Barind Tract. This might then be linked to the Crop Diversification Project funded by the Canadian International Development Agency (CIDA) in Bangladesh. Similar possibilities for other projects need to be considered and suggested, perhaps along the line of the Pigeonpea Production Project in Sri Lanka.

Publicity and technical videos. You have already suggested that videos be made for training scientists. ADB has agreed to support the making of a video concerning the Sri Lanka Pigeonpea Project. Videos are expensive and time-consuming to produce, so there needs to be a clear idea of their benefits when planning them.

Coordination. ICRISAT will continue to support the AGLN. Among changes being considered to improve its effectiveness is the addition of a term position (possibly 2 years) to be filled by a scientist from one of the AGLN countries to be posted at ICRISAT to assist in the AGLN.

There is also a proposal to exchange scientists at ICRISAT with those in AGLN countries. The logistics for this proposal have yet to be worked out, and funding identified.

Between 1 Sep 1990 and 7 Mar 1991, C.L.L. Gowda, the Legume Breeder in the AGLN was posted to Southeast Asia to strengthen our links with the AGLN in that region. If this is found beneficial and funding can be found, we need to consider posting a full-time AGLN scientist in Southeast Asia.

Conclusions

These ideas on future activities and direction of the AGLN are suggested for your consideration. The course of the network continues to be flexible to meet the perceived and demonstrated needs of its members. Donors are increasingly putting restrictions on the activities of the AGLN so that we need to carefully plan activities within these new limits to ensure that they benefit the network, and Asian farmers the most. This is where your input as country-AGLN Coordinators is of significance. We are also looking for guidance and ideas from the observers taking part in this meeting. We wish to draw on their considerable experience and look for ways to interact and strengthen each other's activities. Thank you all for coming here to help guide the future of the AGLN.

Appendix 1

Draft AGLN Purpose and Objectives

The Asian Grain Legumes Network (AGLN) links scientists, administrators, and research organizations committed to collaborate in solving problems in Asia on the AGLN mandate crops --- chickpea, pigeonpea, and groundnut - and the farming systems associated with these crops. It is designed to facilitate collaborative research and the interchange of material and information among scientists so as to strengthen research on these legumes with the ultimate aim of assisting farmers of the Asian region. Research and in-country coordination for the network is provided by national agricultural research systems in Asia. Research backstopping and the AGLN Coordination Unit is provided by ICRISAT.

The objectives of the Network are to:

- maintain and share a regional and network data base
- help identify and prioritize problems related to AGLN crops
- nurture collaboration and interchange of material and information among AGLN members
- foster special problem working groups
- encourage on-farm adaptive research
- promote human resource development
- strengthen links with appropriate regional and international organizations and institutes
- coordinate these activities

Appendix 2

Food Legume Asian Steering Committee

A proposal suggested by IDRC and ACIAR and put forward by AGLN Coordination Unit (CU) to RAS/89/040 Regional Coordination Council Meeting, Beijing, China, Jun 1990.

Background

In response to continuing requests from Asian NARSs for overall coordination of activities associated with research on food legumes in Asia, IDRC and ACIAR sponsored meetings in Bangkok (18-22 Jan 1988 and 30 Apr-1 May 1988) which confirmed the need for such coordination, identified ways in which it might be done, and developed specific proposals for its implementation. Resulting from these meetings IDRC and ACIAR took the first step towards a Steering Committee by asking for bids from NARSs to set up a food legume data base for Southeast Asia. While this search was still in progress, a strong suggestion was made that it might be better if such a Steering Committee was made responsible for coordinating food legume research activities in all of Asia rather than just Southeast Asia, Further, it was felt by some that this Committee might be better organized by the national programs themselves or by some region-wide organization,

From its inception in 1986, Asian Grain Legumes Network (AGLN) cooperators have felt that the AGLN should broaden its terms of reference to cover at least the more important food legumes in Asia. The mandate of the AGLN CU is governed by that of ICRISAT, and ICRISAT can only provide scientific backup for groundnut, chickpea, and pigeonpea and the farming systems involving these crops. However, in response to the AGLN membership's requests, the AGLN CU presented the proposal for a Food Legume

Asian Steering Committee (FLASC) to the First Regional Coordination Committee Meeting (RCCM 1) of the UNDP/RAS/89/040 Food Legume and Coarse Grain Network (FLCGN) in Beijing, 21-23 Jun 1990. That meeting felt that the most appropriate group to carry forward the FLASC initiative would be APAARI which has as its members the Research Directors of all NARS institutions in Asia. Furthermore, since APAARI is funded by the NARSs themselves, it is expected to be a long-term organization unlike time-bound projects such as the FLCGN.

Proposal for a Food Legume Asian Steering Committee (FLASC)

Purpose

- To coordinate activities related to food legume research in Asia
- To ensure research backup for improved production of all food legumes
- To encourage farmer adoption of new technology to improve food legume production

Activities involving food legume research identified for possible coordination:

- Training
- Workshops
- Germplasm exchange
- Trials within a commodity
- Research within a commodity or within a farming system
- Surveys - agroecological
  - socioeconomic
- Data bases and information exchange
- Development of geographical information systems (GIS).
- Modeling
- Postharvest research (including utilization and marketing)

Organization (Figure 1)

- Steering Committee composed of:
  - Coordinators of crops subnetworks
  - Steering Committee Coordinator
  - Representative from APAARI
  - Representatives from other regional groups such as CGPRT and FLCGN
- Steering Committee Coordination Unit
- Crops subnetworks - four possible, that involve:
  - Cool-season legumes; such as chickpea, lentil, lathyrus
  - Warm-season legumes; such as mungbean, black gram, pigeonpea and cowpea
  - Soybean
  - Groundnut

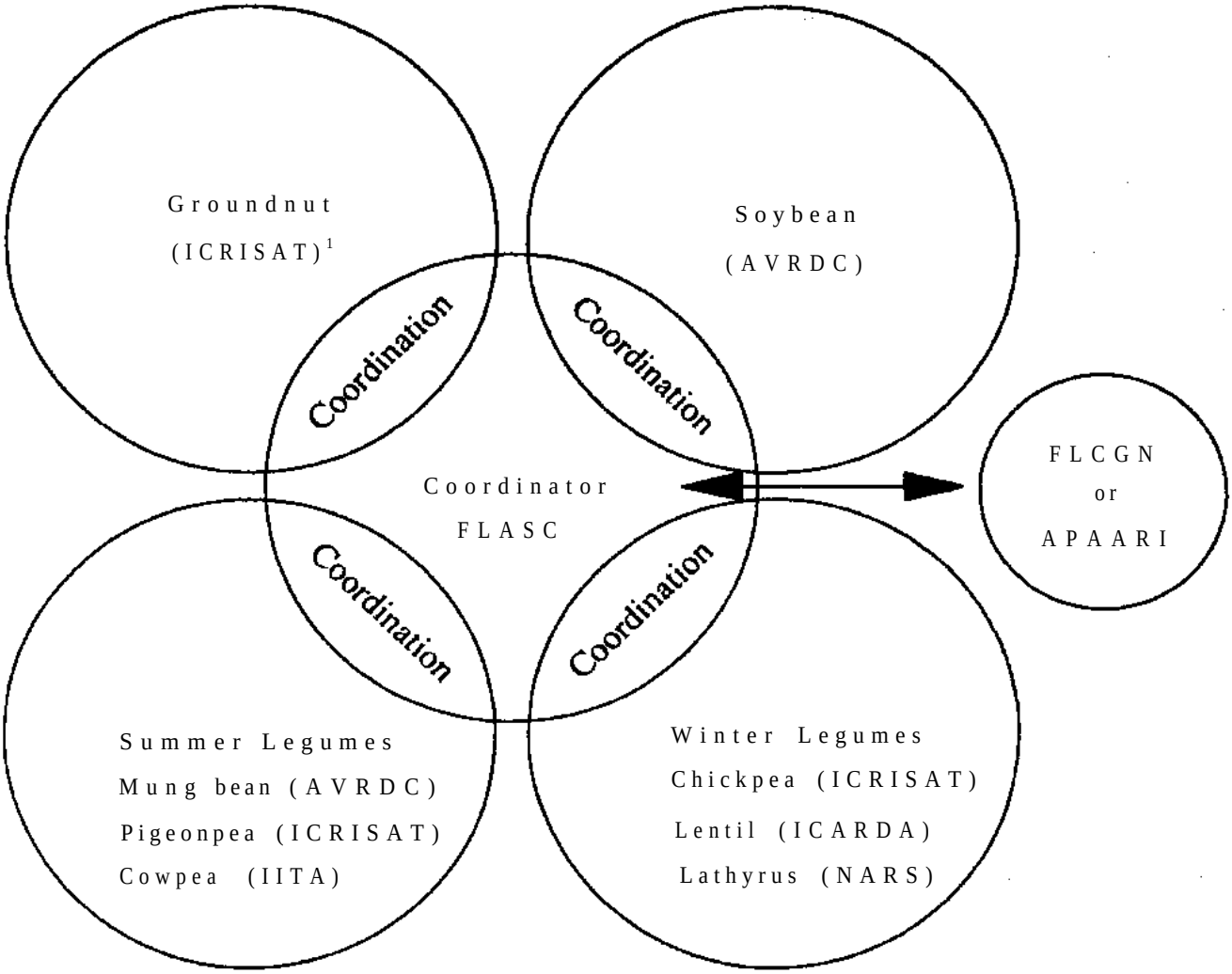


Figure 1. Organizational diagram of the proposed Food Legume Steering Committee (FLASC).

1. For full designations see the acronyms list at the end of these proceedings.

- Lead centers for each crop to be responsible for:
  - collection, evaluation, maintenance, and distribution of germplasm
  - research backup
  - within crop collaborative research

  Note: Some lead centers already exist and could be invited to participate. For example, ICRISAT and the International Center for Agricultural Research in Dry Areas (ICARDA) for chickpea, AVRDC and the International Institute of Tropical Agriculture (IITA) for soybean, IITA for cowpea, ICARDA for lentils, AVRDC for mung bean, CIAT for common beans, and ICRISAT for pigeonpea, and groundnut There is still a need to identify and financially support strong national programs to be the regional lead centers for other crops. There is also a need to work out procedures for free movement of material to and from each country in the region.

. Subnetwork Steering Committee made up of lead centers, major NARSs growing the crops, and representative(s) of NARSs where crops are of minor significance.
- Funding for the following for each subnetwork:
  - Coordination unit
  - Lead eenters'research
  - Clearing bottlenecks in cooperators' collaborative research

Funding

- For an organizational workshop on FLASC
- For staffing and operation of the FLASC Coordination Unit
- For coordination activities of FLASC
- For operation of subnetworks as indicated above

Organizational Workshop-issues to be considered

- Agree on purpose and expected outputs of FLASC
- Suggest ways to make the FLASC reduce overall commitments of NARSs to activities of the several existing networks and so rationalize activities
- Determine interest and level of commitment of NARSs and IARCs to FLASC
- Identify lead center for each crop to provide improved germplasm and research backstopping
- Develop an organizational structure for FLASC
- Identify financial support needed

Action

We would like to recommend that APAARI consider this proposal and carry it forward to meet an identified need for a group to coordinate all food legume research activities in Asia.

NATIONAL REPORTS

Bangladesh

M.A. Khaleque and M.M. Rahman

Bangladesh Agricultural Research Institute, Joydebpur, Gazipur

Introduction

Pulses and oilseeds are both important groups of crops grown in Bangladesh. Statistics from the Bangladesh Bureau of Statistics (1989) show that chickpea ranks third among pulses being grown in the country and is cropped in about 103 000 ha with productivity of 0.725 t ha^{-1}. Pigeonpea grown on 5500 ha with productivity of 0.7 t ha^{-1} contributes less than 1% of the total pulse area, and their production. Groundnut is the third most important oilseed crop, being grown on 38 500 ha with productivity of 1.2 t ha^{-1}.

Bangladesh Agricultural Research Institute (BARI) is the major institution in Bangladesh working to improve cultivation of these crops. Its main objective for legumes is to develop high-yielding varieties with resistance to the major diseases affecting them.

A link was established between BARI and ICRISAT during the 1980s primarily for the improvement of chickpea. This link strengthened with the formation of AGLN in 1986. Major problems and prospects of chickpea in Bangladesh have been identified. BARI is undertaking a research program to overcome some of these problems. Help from ICRISAT is in the form of providing genetic material and scientific support through trials, nurseries, information, and scientific visits. AGLN support for groundnut is still at the initial stage; more support is needed to stimulate rapid promotion of the crop. Although pigeonpea is a minor pulse, limited support from the AGLN can help to develop high-yielding varieties suitable for existing and new cropping patterns.

In the following pages we review the past collaboration between BARI and ICRISAT and suggest some useful measures to strengthen the links to increase the effectiveness of research within AGLN.

Germplasm Development

BARI has regularly received chickpea nurseries and trials from ICRISAT. For groundnut, 71 lines from three botanical groups were introduced from ICRISAT during 1988/89 and are at different stages of testing. Local groundnut germplasm has yet to be collected. More

lines and nurseries should be sent to Bangladesh to help strengthen its varietal development of groundnut. Similarly, both short- and medium-duration pigeonpea nurseries with resistance to sterility mosaic and wilt will help increase the output of legumes in Bangladesh.

Training

A G L N organized an in-country training course in Bangladesh on legumes in Sep 1989 for 34 local legume scientists. Resource persons were from B A R I and I C A R D A for lentil; A V R D C for mung bean; A P A U Station in Guntur, India for black gram, and I C R I S A T for A G L N crops. They delivered lectures on breeding, crop production, disease and insect management, crop physiology, and nutritional quality of legumes. The participants greatly benefited from this course.

Bangladesh has been able to benefit little from the training opportunities at I C R I S A T because of certain national regulations. To overcome this problem, short training courses of less than 8 weeks in specific areas such as disease diagnosis and screening, crossing techniques, germplasm handling and storage, and operation and maintenance of special equipment should be arranged. Research fellowships and postdoctoral fellowships for longer duration should be offered to senior scientists.

Information Transfer

Most A G L N cooperators in Bangladesh receive I C R I S A T publications such as newsletters, workshop proceedings, special bulletins, and C A B abstracts. This information greatly benefits legumes research in Bangladesh.

Under the existing program a chickpea breeder or a pathologist from I C R I S A T visits chickpea experiments in Bangladesh every year during the cropping season. It is suggested that this be modified to include a team of four scientists from I C R I S A T consisting of breeder, pathologist, entomologist, and agronomist with expertise in both chickpea and groundnut, to travel with their counterpart Bangladeshi scientists working on each crop. This may be arranged as a mobile workshop program or a monitoring program once in a cropping season, preferably in the later part of Feb when field problems can be identified and assessed.

A G L N participated in the second National Workshop on Pulses in Bangladesh, Jun 1989, jointly sponsored by B A R I, I D R C, and I C R I S A T The proceedings of the workshop were prepared and published at I C R I S A T.

A scientist from Bangladesh participated in the A G L N Coordinators' tour in Nepal in Mar 1989. Such a program should be considered for all A G L N crops to include scientists in addition to coordinators.

Support to the National Research Program

A memorandum of understanding was signed between Bangladesh and ICRISAT in Nov 1988 and the 1990/91 Bangladesh-ICRISAT work plan is in progress.

AGLN review and planning meetings provide an appropriate forum to identify and discuss problems and assess revisions needed in existing work plans. These meetings also provide an opportunity to share common problems and experiences with other AGLN countries and develop joint programs to solve problems. For instance, at one such meeting botrytis gray mold (BGM) was identified as a major disease affecting chickpea in Bangladesh, Nepal, and parts of India. ICRISAT was requested to develop a BGM-resistant nursery. Similarly, ICRISAT was requested to make crosses of BGM-resistant lines with local cultivars from Bangladesh and supply the F_2 material to Bangladesh for further selection under BGM disease pressure. This program has been started by ICRISAT.

The AGLN can support the Bangladesh national program in the following ways:

- Supply groundnut nurseries resistant to rust (Puccinia arachidis), leaf spots (tikka) (Cercospora arachidicola, Phaeoisariopsis personata), and PStV (peanut stripe virus) diseases from ICRISAT
- Make crosses of Bangladesh groundnut lines with disease-resistant lines at ICRISAT Center and supply F_2 seeds to Bangladesh
- Make crosses for seed dormancy and earliness in groundnut at ICRISAT Center and supply F_2 seeds to Bangladesh
- Provide a groundnut digger and an oil extraction plant to Bangladesh
- Develop a chickpea collar rot resistance nursery
- Develop chickpea varieties responsive to such inputs as irrigation and fertilizers
- Collect root rot pathogens from Bangladesh to be used in the screening program at ICRISAT Center as ICRISAT's root rot resistant chickpea lines have been found susceptible in Bangladesh
- Supply sterility mosaic and wilt-resistant pigeonpea germplasm and nurseries of short- and medium-duration from ICRISAT for testing in Bangladesh
- Supply automatic seed counters, laboratory equipment for protein and fat analysis, and perforated irrigation pipe for field screening against BGM in order to strengthen the research infrastructure in Bangladesh

Coordination

As proposed in the Coordinators' Meeting in 1988, seed of AGLN crops should be sent to individual cooperators or institutions in Bangladesh other than BARI only if the request for the material is forwarded by the Bangladesh-AGLN Coordinators. This will help the coordinators keep track of the total stock of legume germplasm imported into the country. A list of available nurseries and F_2 materials at ICRISAT (identifying crosses against specific diseases) should be sent by the AGLN CU to the appropriate Bangladesh-AGLN Coordinator each year. Also, all the seed material requested should be sent in one container (as done by ICARDA) to facilitate release.

It is requested that the AGLN help Bangladesh procure more germplasm and released varieties of major pulses like lentil, lathyrus, mung bean, and black gram from national programs, especially from India, which is the largest producer of legumes in the world.

India (Chickpea, Pigeonpea)

S. Lal

Directorate of Pulses Research, Kanpur

Introduction

More than a dozen different pulse crops are grown in India. Chickpea and pigeonpea together account for 45% of the total area under pulses and 56% of the total production. During 1988/89 there was a 1.3% increase in the area under chickpea and a 7% increase in pigeonpea. Chickpea registered an 8% increase in production due to better productivity which rose from 0.69 t ha*[1] to 0.74 t ha^{-1}. Most of the increase in the pigeonpea crop area was due to the spread of short-duration varieties, particularly in the irrigated belt of the country where multiple cropping is practiced.

Chickpea is grown under marginal rainfed conditions. Fusarium wilt, ascochyta blight, stunt virus, and pod borer (Helicoverpa armigera) are the major pests affecting chickpea. Pigeonpea is grown mainly as a mixed crop with cotton, sorghum, millet, groundnut, and other oilseed crops. The short-duration varieties are generally grown as a sole crop. Fusarium wilt, sterility mosaic, phytophthora blight, pod borer, and podfly are the major yield reducers affecting pigeonpea.

The research and adaptation work on these two crops in India is carried out by the Directorate of Pulses Research (DPR), institutes that work under the aegis of the Indian Council of Agricultural Research (ICAR), State agricultural universities, State Departments of Agriculture, and the All India Coordinated Pulses Improvement Project (AICPIP).

AICPIP has 33 centers spread throughout India to provide multidisciplinary research in the different agroecological zones of the country. ICRISAT is also closely associated with this project. Because of this collaboration the ICRISAT varieties ICCV 1, ICCV 2, and ICCV 37 of chickpea and ICPL 87, ICPL 151, and ICPH 8 of pigeonpea have been released or identified for cultivation in India. In addition, several Indian technicians and scientists have received training at ICRISAT. AGLN can further assist the AICPIP strengthen the collaboration with ICRISAT and with AGLN member countries.

Germplasm

Germplasm collections of chickpea and pigeonpea are being maintained at the National Bureau of Plant Genetic Resources (NBPGR) and working collections at DPR, Kanpur. This germplasm is made available to AICPIP centers. NARS scientists have access to the germplasm of these pulses which is being maintained at ICRISAT Breeding programs in NARSs worldwide have benefited from this germplasm, particularly for disease resistance and plant type. The AGLN can help in the interchange of germplasm among its member countries especially material with resistance to pests, salinity, alkalinity, abiotic stresses, and suitability to rice fallows. DPR will be glad to provide scientists to help in ICRISAT germplasm collection trips within and outside India. This collaboration will be mutually beneficial for both institutions.

There is a long history of exchange of breeding material between ICAR and ICRISAT scientists but this exchange was only formalized through a MOU signed in Aug 1989. Similar arrangements between ICAR and other AGLN countries have yet to be formalized. At present AICPIP supplies segregating material to other countries only with ICAR approval. AGLN may wish to consider formalizing ties with ICAR.

There are several virus diseases which are seedborne, particularly in Vigna spp. Since we are not well equipped to screen imported material against seedborne diseases, ICRISAT through the AGLN can help by screening material before release.

For quick movement, chickpea seeds for ICARDA trials in India could be routed through ICRISAT for clearance by expanding the ICRISAT postentry quarantine facilities to handle all such trials coming into India.

Training

ICRISAT has arranged training for scientists and technicians from the Indian national program. Our future training needs will be in the areas of biotechnological approaches, genetic engineering, rapid and accurate screening procedures, physiological and biochemical research, and studies on physiological races of pathogens.

It is suggested that AICPIP scientists be sponsored by ICRISAT through the AGLN for training abroad in critical areas. ICRISAT in collaboration with ICAR is soon organizing a training course on hybrid pigeonpea. It is suggested that Indian crop research institutes are in a good position to provide resource persons for training programs organized by ICRISAT, including those conducted outside India.

Monitoring

The monitoring of research programs, survey for disease and pest incidence, and crop production tours are very important. Such activities have recently brought out the following:

- The incidence of sterility mosaic and phytophthora diseases affecting pigeonpea is increasing

- Alternaria blight severely affects pigeonpea, making cultivation of the legume difficult during the winter season
- Short-duration pigeonpea varieties are becoming popular in the irrigated tracts of northern India as part of the pigeonpea-wheat cropping system
- Almost all long-duration varieties of pigeonpea are grown in mixed cropping systems, whereas short-duration genotypes are grown mainly as a sole crop
- Helicoverpa armigera (pod borer) is a very serious pest on short-duration varieties of pigeonpea
- Botrytis gray mold {Botrytis cinerea) disease in chickpea is increasing in intensity
- The area under chickpea in the irrigated belt of Uttar Pradesh, Haryana, and Punjab is declining
- The use of fertilizer and irrigation in northwestern India causes heavy vegetative growth in chickpea and results in poor podding
- Ascochyta blight (Ascochyta rabiei) disease in chickpea is becoming more important
- Inadequate quality seed of short-duration varieties is a production constraint in pigeonpea
- Stemphylium is becoming a serious disease in chickpea, particularly in the rice fallows of Bihar, Uttar Pradesh, and West Bengal

Information Transfer

The meetings of chickpea and pigeonpea scientists organized by ICRISAT seem to have been discontinued, or are not being held regularly. As these meetings are very useful for the exchange of ideas, and selection of breeding material and germplasm lines, this activity should be reactivated.

Monitoring tours of research experiments and production surveys are important. As the Indian national program is unable to carry out these activities due to constraints in mobility, travel funds, and manpower, ICRISAT could facilitate.

A list of ICRISAT publications should be circulated to all AICPIP centres and to DPR.

Working groups on important problems should be constituted and an annual progress report of each group should be compiled and distributed. These reports should include the latest references on a global basis and the advances made during the year.

AGLN's Ultimate Product

We suggest that the AGLN can assist in the following ways:

- Help procure seed from other countries
- Provide training in peripheral areas at ICRISAT and abroad
- Help in strategic research and provide basic material including segregating and elite lines
- Confirm specific traits of breeding material and germplasm lines provided by Indian scientists

- Develop agroclimatic zones for each crop based on'soil, weather, and crop response
- Develop plant ideotype concepts for different agroclimatic zones
- Help procure sophisticated equipment
- Arrange visits to other A G L N countries
- Develop disease and pest incidence forecasting systems, and provide information on a regional level

India (Groundnut)

P.S. Reddy

National Research Centre for Groundnut, Junagadh

Introduction

India is the largest producer of groundnut in the world with an area of 7.7 m ha under the crop and production of 6.8 million t. The crop is grown in many agroclimatic regions of the country throughout the year. The potential yield of groundnut is not being realized because of several production constraints. Efforts are being made at the National Research Centre for Groundnut (NRCG) and other NARS institutions in India to develop suitable technologies to overcome these constraints. These research centers are collaborating through the All India Coordinated Research Projects on Oilseeds (AICORPO) of ICAR and through ICRISAT. AGLN can further assist the Indian NARS strengthen this collaboration at an international level to enable the Indian NARS use its scarce resources effectively.

Germplasm

As a national repository the NRCG maintains 5600 groundnut germplasm accessions. These accessions are being supplied on request to research organizations. As the Centre's collection does not yet have all the released groundnut varieties from other Asian countries, AGLN can help NRCG procure released groundnut varieties and accessions with special qualities from other Asian countries. Such special qualities could include cold tolerance and early maturity from the People's Republic of China, shade tolerance and acid tolerance from the Philippines, and accessions for rice fallows from Vietnam, Indonesia, and the Philippines. Scientists from the NRCG are available to participate in exploration teams or visits to other Asian countries.

Breeding Material

There are six international trials on groundnut from ICRISAT which mainly contain material that has done well in AICORPO multilocational trials. Presently these trials are only sent to countries other than India. AGLN might benefit if these trials were also grown at contrasting locations within India.

Segregating material is flowing from ICRISAT to the Indian NARS. It would benefit the Indian NARS if material is also made available from other AGLN countries. Similarly, NRCG can offer segregating material to other countries with ICAR approval.

Training

Indian scientists are being trained at ICRISAT in highly specialized courses. It is suggested that technicians from the NRCG and the Indian NARS be allocated slots in ICRISAT's in-service training courses. These trained technicians would help scientists accelerate the pace of their research. No in-country training program has yet been conducted in India through the AGLN. A course on 'groundnut production/protection technology' might be organized in India jointly by NRCG and ICRISAT

Monitoring Tours

About 10 survey programs were undertaken by the AGLN but none of them have been in India. Since groundnut is grown across widely different agroclimatic zones in India, it is an ideal country for conducting monitoring tours to gain information on changes in technologies, varieties, cropping systems, pests, and diseases. For instance, a short survey around Junagadh district by NRCG scientists in Sep 1990 revealed that:

- Stem rot caused by Sclerotium rolfsii is on the increase, causing severe damage particularly to bunch types
- Rhizoctonia solani was present in the farmers' fields
- S. rolfsii attacked groundnut foliage when conditions were favorable
- Besides solo cropping, groundnut is grown in several intercropping patterns

Indian scientists are available to participate in monitoring tours throughout Asia.

Information Transfer

Visits by Indian NARS scientists to ICRISAT have helped them learn about the latest research. Workshops on current topics have helped them plan their future research. These workshops should invite participants from a wide range of agroclimatic regions to ensure that Indian scientists share information with a large group of colleagues. The AGLN should encourage small group in-country discussions by workshop participants when they

return to their countries. Scientists from centers of excellence in each country should be involved in the AGLN working groups.

AGLN publications should be distributed to libraries of all Indian NARS centers working on groundnut. A publication comparing production technologies in AGLN countries should be brought out by AGLN and groundnut germplasm catalogues should be exchanged among cooperators through the network. The possibility of linking germplasm data banks through computers should be explored. The AGLN should also publish a quarterly literature update for its ICRISAT mandate legumes similar to the Rice Update published by IRRI.

Collaborative Research

Nine ICRISAT-ICAR approved collaborative projects are in progress at NRCG, ICRISAT, and other NARS centers. These projects aim to:

- develop and exchange segregating breeding material
- screen against fungal and viral diseases
- screen for resistance to insect pests
- characterize wild relatives of Arachis and their progenies under normal and drought conditions
- conduct a national drought nursery
- conduct basic studies on drought
- study physiological basis of productivity
- evaluate improved groundnut production technologies and their economics
- compare improved technology with technology recommended by the NARS to assist in technology transfer. India's competence should be considered when identifying consultants for AGLN activities.

NRCG has been identified as a collaborator in the project on surveying the incidence of peanut stripe virus (PStV) and peanut mosaic virus (PMV). For this NRCG should be provided with relevant chemicals, antisera, and equipment such as an Enzyme-Linked Immunosorbent Assay (ELISA) reader.

In the project dealing with foliar diseases, a national facility with temperature and humidity control is needed for screening material generated at the NRCG. AGLN may consider financing its construction.

Coordination

The links between AGLN and the Indian NARS needs further strengthening. The AGLN Coordinator and the India-AGLN Coordinators should meet more frequently to effectively monitor the collaborative projects.

AGLN's Ultimate Product

Attainment of better productivity and quality of groundnut in Asia should be the ultimate goal of the AGLN. This can be accomplished through AGLN by:

- Assisting in better technology generation
- Offering training opportunities to young scientists
- Helping acquire sophisticated equipment
- Funding group visits to production centers in countries that are part of the network

Myanmar

U Kyaw Moe

Agricultural Research Institute, Yezin

Introduction

Food legumes are important in Myanmar for local consumption and export, and are grown in rice-based and other cropping systems. Several food legume species, including groundnut and soybean, have been cultivated in Myanmar for many decades. At present high prices of food legumes have attracted the attention of growers, and hence there is great potential to increase the crop area under food legumes. For varietal improvement and increased crop production of groundnut, chickpea, and pigeonpea, Myanma Agriculture Service (MAS) has cooperated with ICRISAT since 1976. To establish stronger collaboration between MAS and ICRISAT for improving food legumes, a MOU was signed in 1986. Under this MOU, annual research programs, exchange visits of senior scientists from both organizations for discussions and meetings is facilitated, Myanma research staff are trained at ICRISAT, and Myanma scientists participate in AGLN meetings,

Germplasm

Since 1976, the Myanmar research program has annually received for testing groundnut, chickpea, and pigeonpea breeding lines from ICRISAT. In addition, screening against drought, insect pests, and diseases has also been carried out. Germplasm collection of chickpea and groundnut landraces have been conducted in Myanmar in collaboration with ICRISAT scientists and a replica set of all collected material supplied to ICRISAT for maintenance and future research. Although seeds from ICRISAT are usually sent 2 months ahead of the planting season through the FAO office in Myanmar, these still arrive late for

timely planting. It is therefore suggested that all seed materials from ICRISAT be sent directly to the General Manager of Agricultural Research, MAS.

Training

Seven trainees were sent from Myanmar to ICRISAT from 1981 to 1985 to study crop improvement and production technologies of groundnut. All of them are working on research farms in the major groundnut-growing areas. The trained persons are making valuable contributions by passing on their knowledge and experience to their colleagues. Similar contribution can be expected from the Myanma research staff trained on pigeonpea and chickpea improvement. We request ICRISAT to provide more opportunities for short-term in-service training to Myanma scientists in crop breeding, crop production, and crop quality. The number of trainees should be at least seven for the May course and five for the Sep course. An in-country training course in Myanmar has been planned and is to be conducted in Jan 1991. The training is expected to meet the objectives of the national program as it would cover both ICRISAT mandate crops and other legumes such as mung bean, black gram, and cowpea.

Information Transfer

Visits of scientists from Myanmar to ICRISAT are arranged through AGLN. These visits provide opportunities to discuss aspects of ICRISAT's mandate crops, and crop production in Myanmar. Also, the visiting scientists familiarize themselves with ongoing research at ICRISAT and select seed material and technology for use in Myanmar.

There are annual visits of ICRISAT scientists to Myanmar, to help evaluate material being tested, and to make suggestions for solving problems. ICRISAT scientists also contribute through participation in seminars and discussions. As this kind of information transfer is useful, visiting ICRISAT scientists are requested to bring along illustrative material on slides or video tapes. At least one exchange visit should be made annually for each crop.

A survey of chickpea and pigeonpea disease problems was undertaken along with the monitoring tour in Myanmar 6-15 Feb 1990. The monitoring tour was part of the MAS-AGLN cooperative work plan. As it was a systematic multidisciplinary approach many useful future research strategies were drawn up by the group. These valuable suggestions will form part of the national research program. It is suggested that the monitoring tours should place greater emphasis on the survey aspect.

Workshops are useful for sharing the latest research findings and discussing recent developments within the NARS. It is suggested that the proceedings of workshops be compiled and sent as early as possible to participants. Although pamphlets and publications are important for information transfer, audio-visual aids are more effective for technology transfer to trainees and farmers. Therefore, ICRISAT should prepare video tape and slide packs with text on "Techniques of planting ICRISAT mandate crops", as done by organizations such as FAO/RAS/82/002.

Support to National Research Program

During review and planning meetings, scientists from ICRISAT and Myanmar had frank and friendly discussions and made decisions about national research programs. It was decided that for rapid progress, ICRISAT should place a chickpea consultant in Myanmar on a long-term basis. In addition, Myanmar staff should be trained to handle different research aspects of chickpea and pigeonpea. AGLN / ICRISAT is the only source of financial assistance for research on legumes in Myanmar, Through AGLN we hope to fill the gaps in achieving our national research targets on these crops. Provision of supplies and equipment would also be very helpful as would the supply of chemicals and glassware to accelerate the pace of studies on the wilt pathogen in Myanmar.

Results of Collaborative Research

Traditional varieties of pigeonpea in Myanmar are photosensitive and of long duration. These are usually intercropped with sesamum, groundnut or short-staple cotton. The cultivars introduced from ICRISAT are of short duration and photoinsensitive, with high grain-yielding ability. The new type of cultivar can be grown as a sole crop after the harvest of an early monsoon crop. The spread of the improved types have been slow, because of their low biomass yield for fuel. As grain prices have become more favourable, the new cultivars (ICPLs 87 and 83024) are becoming popular with farmers. To accelerate the acceptance of these cultivars, there is a need for legumes on-farm testing and maximization trials.

Out of 31 chickpea lines sent by ICRISAT, ICC 11322 has been identified as a wilt-resistant line by our pathologists. Four lines, ICCX 730008-8-1-1P-BP, ICC 506, ICCX 790197-25PLB-12PLB-3PLB-BPLB, and ICCX 790197-3PLB-3PLB-2EB were identified as tolerant at all testing sites over 3 years in Helicoverpa screening nurseries in Myanmar. More seed of these cultivars is needed for yield trials.

Coordination

The AGLN CU actively cooperates with us. The material, equipment, and publications we ask for are sent to us promptly.

AGLN's Ultimate Product

Scientists and policy makers have paid little attention to food legumes when compared to other crops such as cereals, oilseeds, and industrial crops. Today, legumes have gained in importance in Myanmar due to their export potential. To strengthen this phase of legume improvement and production in Myanmar, improved varieties, better technology, training, and more funds are needed.

Nepal (Chickpea, Pigeonpea)

C.R. Yadav

National Grain Legumes Research Program, Rampur

Introduction

Chickpea and pigeonpea are important grain legumes in Nepal. These crops are grown as sole or mixed crops mainly in the Terai and Inner Terai regions of the country. Over the last 3 years there has been a slight decline in the area under chickpea, but pigeonpea has maintained its upward trend. The productivity of both these crops has declined (Table 1). These declines are mainly related to the increased incidence of botrytis gray mold (BGM) on chickpea and sterility mosaic (SM) on pigeonpea.

Table 1. Area (A) (000 ha), production (P) (000 t) and yield (Y) (t ha^{-1}) for chickpea and pigeonpea in Nepal 1986- 89.

	1986/87			1987/88			1988/89		
Crop	A	P	Y	A	P	Y	A	P	Y
Chickpea	31	21	0.68	30	16	0.53	29	18	0.60
Pigeonpea	17	13	0.76	18	9	0.50	18	12	0.68

Source: DFAMS (Department of Food and Agriculture Marketing Service), Nepal

Chickpea research started in Nepal in 1973 and pigeonpea research in 1977 under the supervision of the Agronomy Division, Khumaltar, and the Agriculture Station, Parwanipur. Collaborative research on chickpea and pigeonpea with ICRISAT started during 1975 / 76, This collaboration was strengthened after the establishment of the National Grain Legumes Research Program (NGLRP) in Nepal and ICRISAT through AGLN. This paper aims to review the collaborative research activities carried out between NGLRP of the National Agricultural Research Center (NARC) and ICRISAT through AGLN.

Trials and Materials

Chickpea. Five national and four international yield trials, five pathological, one entomological, and four agronomical/microbiological trials were conducted during 1989 / 90.

The results are summarized.

- ICCL 82108 was the top yielder in farmer's field trials. Kabuli line ICCC 32 was the top yielder at the Nepalgunj Agricultural Station (NAS). Both of these lines consistently performed well over 1987-89, and have been released as Kalika (ICCL 82018) and Koseli (ICCC 32).
- Derivatives of Dhanush x K 850 were top yielders in the initial evaluation trial at four locations. Line ICC 4102-36 produced the highest grain yield (0.829 t ha^{-1}).
- Encouraging tolerance to B G M in ICCC 32 mutant selections was observed. At Rampur, Tolkan at 2 kg ha^{-1} was the most effective chemical for weed control.
- Pod borer was most severe when chickpea was sown early, 7 Nov (11.7%) and 17 Nov (9.7%).
- Out of 40 chickpea genotypes 10 were found promising against Helicoverpa.
- Delayed sowing significantly reduced B G M on chickpea. Very poor fruit set even in late-sown chickpea indicated that the heavy flower drop in chickpea at Rampur is not caused by B G M alone. There is an urgent need to establish the relationship between B G M, flower drop, and other factors to help stabilize chickpea production in Nepal.
- Among 107 chickpea genotypes, 13 were identified as tolerant to root knot nematode.

Pigeonpea. Eight national and five international yield trials and four other trials were conducted in 1989/90. Highlights of the findings are given below.

- Unusually heavy rain in western Nepal during pod formation, coupled with very low temperatures and foggy weather from Dec 1989 to mid January 1990 in central and eastern Nepal, adversely affected yield of medium- and long-duration pigeonpea trials. There were severe incidences of SM, podfly, and pod borer in farmers' fields.
- Medium and long-duration trials:
  - Initial evaluation trial at NAS and NORP, PR 5164 gave 0.98 t ha^{1}
  - CVT's at NAS, NORP, and Surkhet PR 5164 averaged 1.59 t ha^{-1}, Sarlahi 11.45 t ha^{-1}, and PR 5147 1.35 t ha^{-1}
  - FFT - PR 5164 yielded 0.90 t ha^{-1}, PR 5147 yielded 0.67 t ha^{1}, and ICPL 366 0.51 t ha^{-1}
- Short- and medium-duration trials:
  - Coordinated Variety Trial (CVT) at Rampur, NAS, and National Oilseed Research Program (NORP), Rampur Local averaged 1.5 t ha^{-1}, ICPL 151 0.97 t ha^{1}, ICPL 86005 0.95 t ha^{-1}, and ICPL 86012 0.88 t ha^{-1}
  - Rampur Local was consistently good across locations, ICPL 146, very good in western Nepal; both are resistant to SM and are likely candidates for release
  - In the medium-maturity trial at NAS, ICPL 89044 yielded 0.92 t ha^{1} and ICPL 89046 0.911 ha^{-1}
- Extra short-duration trials:
  - In pigeonpea-based intercropping trials, at Rampur, Nawalpur, and Nepalgunj, pigeonpea and maize gave the highest gross return of 12% over sole pigeonpea at Rampur, 25% at Nawalpur, and 53% at Nepalgunj
  - ICPs 7035 and 8324 were free from sterility mosaic disease

Survey and Monitoring Tours

Joint monitoring tours involving NGLRP and ICRISAT scientists were conducted to evaluate chickpea and pigeonpea trials.

Germplasm

Collection and characterization of legumes germplasm in Nepal sponsored by NGLRP, ICRISAT, and IDRC was completed and the results compiled in the publication "Collection and characterization of legumes germplasm in Nepal" by B.J. Furman and M P. Bharati.

Training

Two research workers attended the 6 month in-service training course and two pathologists attended the virology training course at ICRISAT during 1989/90.

Visits

Nine scientists from ICRISAT visited Nepal and eight scientists from Nepal visited ICRISAT during 1989/90. The ICRISAT External Program Review team visited Nepal to evaluate collaborative activities between Nepal and ICRISAT

AGLN Cooperators

The Nepal-AGLN Coordinator continued the distribution of application forms to individuals and institutions interested in becoming AGLN cooperators.

Literature

NGLRP has continuously received copies of the International Arachis, Chickpea, and Pigeonpea Newsletters. A limited number of books have been received from ICRISAT at the NGLRP Library, Rampur.

Workshops and Meetings

- Three participants attended the AGLOR Planning Meeting at ICRISAT in Nov 1989 and visited on-farm trials in India.

. Two participants attended the International Workshop on Chickpea Improvement at ICRISAT in Dec 1989.
- The National Agricultural Research Centre (NARC) issued invitations to ICRISAT scientists to participate in the Nepal Summer and Winter Crop Workshop Group Meetings.

Equipment

A microscope and a Pullman thresher were received by NGLRP from ICRISAT. ICRISAT has also helped procure some small laboratory equipment and supplies.

Nepal Coordinator for AGLN

Dr M.P. Bharati is on sabbatical leave. Therefore, Chitranjan Yadav will coordinate activities on chickpea and pigeonpea, and D.S. Pathic on groundnut.

Acknowledgements

The AGLN CU has been extremely helpful in facilitating NGLRP activities in Nepal. Periodic visits of ICRISAT scientists and input from Dr Onkar Singh during planting and evaluation have helped implement research activities.

Nepal (Groundnut)

D.S. Pathic

National Oilseed Research Program, Nawalpur

Introduction

Agriculture is the largest segment in the Nepalese economy; it contributes more than 60% of the total export earnings and involves about 93% of the total population. Cereals are the main food crops grown while oilseed crops, sugarcane, jute, and tobacco are the main cash crops. Rapeseed and mustard are the most important oil crops cultivated followed by groundnut, sesame, niger, and linseed. Oilseed crops occupy 153 000 ha and produce 98 060 t of oilseeds. The area under groundnut is not extensive but this crop is gaining popularity and in recent years, farmers in several districts have started growing groundnut.

Since early 1980, ICRISAT has provided test materials of groundnut to **NORP** in Nepal and some short-duration genotypes are in the pipeline- One of the growing concerns to groundnut farmers is the steady decrease in pod yields. Since reasons for this reduction are not clear, serious efforts must be made to locate and overcome the possible causes.

Research

Collaborative research is being conducted at NORP. Yield levels have been good. In the CVT, ICRISAT early genotype (110-120 days maturity) ICGS(E) 52 yielded 2116; ICGS 36, 2036; and ICGS 30, 1999 kg ha^{-1}.

In the international medium and late groundnut varietal trial from ICRISAT, ICGV 87137 yielded 1788 kg ha^{-1} and ICGV 87149, 1717 kg ha^{-1}. In the international early groundnut varietal trial, ICGV 86014 yielded 1608 kg ha^{-1} and ICGV 86015, 1135 kg. ha^{-1}. In the international confectionery varietal trial, ICGV 86567 yielded 1432 kg ha^{-1} followed by ICGV 86548 with 1371 kg ha^{-1}.

In agronomy trials raised beds showed no advantages over flat plantings and it was confirmed that maize and groundnut can be grown successfully in the intercrop combination of three rows of groundnut to one row of maize.

In disease trials, ICG 7892, ICG 8298, RY 004, RY 006, RY 007, and RY 008 were found tolerant to early leaf spot under field conditions at NORR In a screening study, ICGV 87168, ICGV 87182, Trishuli Mahili, Janak, and B4 were found tolerant to late leaf spot. Sumi-8 at 2 g 1^{-1} efficiently controlled groundnut rust. ICRISAT materials had average yields of 2667 kg ha^{-1} for ICGS(E) 52 followed by 2040 kg ha^{-1} for ICGS(E) 56 over nine districts. ICGS 36 averaged 1253 kg ha^{-1} in farmer's field trials (FFT).

Germplasm

Much groundnut germplasm from ICRISAT has been introduced into Nepal through AGLN and tested under field conditions. The most promising germplasm include ICGS(E) 52, ICGS(E) 56, and ICGS 36. The flow of germplasm should continue but the delivery mechanism needs to be improved.

So far NORP has collected only six local lines. More local germplasm should be collected and evaluated at NORP, and at different agricultural research centers in the country.

Training

Although training is very important to groundnut scientists, nobody from Nepal was able to participate in groundnut training programs during 1990- NORP scientists need training in groundnut breeding, integrated pest management, soil science, and seed production.

Short-term training is needed for research management and for the handling and maintenance of equipment.

Equipment

Equipment required for groundnut research and trials in Nepal have been listed in the work plan.

Information Dissemination, Monitoring Tours

Information transfer is very important for effective use of technology. AGLN is requested to provide publications to all groundnut cooperators at agricultural research centers in the country.

Seminars and workshops provide a chance for researchers to present papers and pass on recommendations to groundnut extension workers. Monitoring tours and traveling seminars allow research scientists to visit experiments, demonstrations, and farmers' fields enable them to identify and discuss problems, and suggest possible solutions. To be most effective this needs to be a regular activity.

Support to National Research Program

AGLN Review and Planning Meetings are appropriate for scientists to discuss findings and achievements and identify farmers' needs.

Coordination

Since its inception, AGLN has supported NORP by arranging and providing germplasm and other material for evaluation, material for screening studies, training, visits, equipment and supplies, working group meetings, AGLN coordinators' meetings, funds to meet the expenses of research, logistic support, and publications.

AGLN's Ultimate Product

To attain the ultimate goal of increasing groundnut production in Nepal, AGLN should help:

- Generate appropriate technology
- Translate appropriate technology into production practices
- Make germplasm available from other network countries
- Provide training to researchers

- Provide equipment required for groundnut research
- Fund visits and collaboration with other AGLN countries

. Support on-farm research activities

People's Republic of China

Hu Jiapeng

Institute of Crop Germplasm Resources,
Chinese Academy of Agricultural Sciences, Beijing

ICRISAT-China Collaboration

Cooperation between China and ICRISAT started in 1980 but it was only after 1986 that visits of scientists, staff training, and germplasm exchange increased greatly- With the signing of the MOU between the Chinese Academy of Agricultural Sciences (CAAS) and ICRISAT on 2 May 1988 the cooperation received further impetus. Collaborative research activities of interest to China formally started after the first work plan was signed on 20 Sep 1989. The author was nominated as the country-AGLN Coordinator in 1990 to execute these plans. Although most of the activities are concentrated on groundnut, some limited input into the other mandate crops of ICRISAT has been provided particularly for germplasm exchange.

Germplasm

Trials received included 2 sets of IEGVT (International Early Maturing Groundnut Varietal Trial), 1 EXPIT (Extra Early Pigeonpea International Trial) and l EPIT (Early Pigeonpea International Trial). In addition, we received one CIYT (Chickpea International Yield Trial) from ICARDA. Of 75 germplasm samples received so far, 63 were groundnut lines, and 6 lines each were of pigeonpea and chickpea. These trials and material have been extensively studied by Chinese scientists and material of interest has been identified. For example, chickpea lines FLIP 81-40W and FLIP 81-71C have expanded to 40 locations in 20 provinces in China. These lines have good adaptability and tolerance to drought. Their yield ranged from 3.24-3.59 t ha^{-1} which was 22-35% more than the local variety,

Training

Training of Chinese staff at ICRISAT started in 1980. Up to 1990, 51 persons attended training courses at ICRISAT ranging from 3 to 30 weeks each. Most of them stayed at ICRISAT for at least 3 months.

The reactions of Chinese trainees towards training at ICRISAT is very good and they are playing an important role in the agricultural development of the country. A groundnut virus identification course was successfully concluded in Wuhan in Oct 1990. Ten trainees with varying backgrounds participated in the 10-day course that laid special emphasis on seed-borne viruses. Resource persons were drawn from China, ICRISAT, and the University of Georgia, USA. Financial support for the course came from ADB, Georgia Foundation, Peanut CRSP, and ICRISAT. This course should greatly benefit groundnut research and production programs in China.

Information Transfer

Chinese scientists participated in several international meetings and workshops at ICRISAT and in Indonesia (through ICRISAT) from 1987 to 1990. In addition, at least 10 Chinese visited ICRISAT and 7 ICRISAT scientists visited China on six different occasions. Two survey trips were also conducted during the same period. Dr Gan Xiaosong, Vice President, CAAS, participated in the ICAR-ICRISAT Asian Research Directors Study Tour in Oct 1990. All these activities increased our understanding of research areas that would require more contact and cooperation. We feel that the present extent of exchange is not sufficient for our country and hope that it will increase.

Support to the National Research Program

China has about 1.4 m ha land under legumes with an annual production of 2.1 m t. Groundnut is the second major legume after soybean. Chickpea and pigeonpea are cropped over large areas but are relatively unimportant. The north and northwest part of China offers good growing conditions for chickpea and lentil; the south and southwest of China have extensive hilly areas where pigeonpea is cultivated. There is ample scope to further train the existing teams of grain legume research workers. If new projects are set up, each project would need 50-100 research staff members and adequate financial support. Some specific proposals are as follows:

- International chickpea cooperative trial (kabuli) in north and northwest China
- International pigeonpea trials in south and southwest China
- Trial of summer groundnut followed by wheat in north and central China
- Popularization of newly developed lines of groundnut, chickpea, and pigeonpea
- Survey of pigeonpea production and collection of local pigeonpea varieties
- Establishment of an enzymatic analysis and cell dissection laboratory

We also wish to continue cooperation in training, visits, workshops, meetings, and information exchange. We look forward to continuing support for these and other research activities on legumes through our association with AGLN.

Philippines

C.R. Escario

Philippine Council for Agriculture, Forestry, and Natural Resources Research and Development, Los Banos, Laguna

Introduction

Collaboration between the Philippine Council for Agriculture, Forestry, and Natural Resources Research and Development (PCARRD) and ICRISAT dates back to 1975 when they signed a memorandum of agreement. Since then, many cooperative undertakings have been accomplished, including the participation of legume researchers from Philippines in the AGLN. The following activities with ICRISAT through AGLN have contributed significantly to the Philippine Legumes Research and Development (R & D) Program: access to AGLN germplasm, non-degree training, exchange visits of scientists, and information transfer.

The Philippines/PCARRD-AGLN/ICRISAT Review and Planning Workshop was held 22-23 Oct 1990 at PCARRD. The workshop reviewed legume research particularly on groundnut and pigeonpea, identified research needs, developed strategies and action plans for effective and strong legume research, and identified training and information needs.

Germplasm

An important contribution of AGLN is its commitment to provide germplasm material to its cooperators. Some of the material included in trials has proved promising and adapted well to Philippine conditions. Other varieties have been identified as potential sources of resistance against important insect pests and diseases.

Receiving materials by mail has posed several problems as the current procedure is bureaucratic and causes delays. To speed up movement it was suggested during the workshop that seed shipments be routed through IRRl's Asian Rice Farming Systems Network.

Training

During the PGARRD-AGLN workshop, the regular training courses offered at ICRISAT and their purposes were outlined. Participants who have received ICRISAT training grants indicate that the courses have been relevant and very useful in their respective fields. No major changes were suggested to the contents or structure of the present training courses. To date, a total of 25 Filipino legume researchers have participated in in-service training courses, conferences, and meetings sponsored by ICRISAT.

Information Transfer

Information transfer can be achieved through exchange of scientists, monitoring tours, workshops, and publications. At present, researchers have limited access to AGLN/ICRISAT publications. For more effective information transfer AGLN should regularly provide all relevant publications to all cooperators, not just research highlights and updates on AGLN activities.

Workshops allow scientists to exchange ideas and information of mutual benefit. Many Filipino scientists have attended ICRISAT-organized meetings and workshops and have been asked to serve as resource persons and speakers. Workshops should be held regularly and must be a continuing activity.

Monitoring tours were likewise considered very useful. It is suggested that representatives from major groundnut-producing countries be invited to join tours in other groundnut-producing countries. This would help them gain insight into new technologies that might be adopted to improve production in their own countries. Surveys are especially needed to identify problems in legume production. Surveys could be integrated into monitoring tours and workshops to optimize resources.

Support to the National R & D Program

The recently concluded review and planning meeting was very fruitful. It served as a forum to thrash out problems, identify gaps, and draw up plans. The following were proposed for AGLN funding:

Groundnut The following activities were proposed:

- Breed for high yielding, seed quality, and resistance to diseases and insect pests, and tolerance to shade, and acid soil
- Determine genetic coefficients for crop modeling
- Study inheritance of shade and acid soil tolerance
- Introduce earliness and dormancy

Pigeonpea. The following activities were proposed for short- and medium-duration types:

- Breed high-yielding, pod-borer resistant vegetable types
- Breed for waterlogging tolerance and wilt (fusarium) resistance
- Study processing of green (freezing and canning) and dry seeds (flour)

A researcher from the Institute of Plant Breeding described legume breeding in the Philippines as an "open" activity because of unreliable funding for this type of research. Funding by an agency like the AGLN would therefore be a great help and a boost to the country's legume breeding program.

Results of Collaborative Research

Collaborative research on AGLN crops is mainly carried out by staff trained at ICRISAT. Germplasm of groundnut, pigeonpea, and chickpea are sent by ICRISAT and have been included in local trials. These are some important findings reported during the PCARRD-AGLN workshop.

Groundnut. ICRISAT introductions JL-24 at 2.33 t ha^{-1}, Robut 33-1 at 1.35 t ha^{1}, and ICG (FDRS) 11 at 1.22 t ha^{-1} were the top three yielders during the 1986/87 dry cropping seasons. The check variety UPL Pn4 yielded 1.0 t ha^{-1}.

Pigeonpea. Two pigeonpea accessions from ICRISAT, Acc 559 and ICPL 84045, were found tolerant to pod borers. These can be used as parents or even as vegetable varieties in some areas. At the Mariano Marcos State University (MMSU), ICPLs 87, 151, 83033, 83034, and 85014 were promising.

Chickpea. In a limited trial conducted at MMSU, ICCVs 2, and 5, and K 850 were promising lines of chickpea under Ilocos conditions.

General

As a major legume crop in the country groundnut has been receiving considerable support from sources such as Peanut CRSR AGLN has contributed to collaborative research in the Philippines by its continuing interest in developing pigeonpea and chickpea, both of which at present are minor crops. Given enough attention pigeonpea has the potential of providing an alternative source of protein, while local production of chickpea would help reduce or replace chickpea imports and thus conserve the dollar reserves of the country.

Coordination

The present system of coordination is not a problem in the Philippines since the country has a well-developed network of research agencies/institutions, NARRDN (Natural Resources Research and Development Network), with PCARRD as the coordinator. To

strengthen Philippine-AGLN collaboration, five task forces were suggested by participants of the Philippine-AGLN Review and Planning Meeting. The task forces will need to be fully supported financially before they can implement the plans and programs they have drafted. These task forces have to focus on: training and workshops, germplasm collection and testing, crop protection, cultural management, and on-farm trials.

AGLN's Ultimate Product

In the Philippines, AGLN is looked upon as a partner in the development of the legumes R & D program, with emphasis on groundnut, pigeonpea, and chickpea. AGLN should continue to serve as a source of germplasm and improved varieties, training for legume researchers, and more funds for collaborative trials. All these are envisioned to contribute to the ultimate objective of increasing and sustaining production of groundnut, pigeonpea and chickpea in the Philippines.

Sri Lanka

S.J.R.A. Jayasekera

Agricultural Research Station, Pallekele, Kundasale

Introduction

Grain legumes form a major component of farming systems in the dry zone of Sri Lanka. Many species are utilized, both in sole cropping and in intercropping, or in relay cropping with cereals and other crops.

Farmer's yields are much lower than the potential of these crops. Reasons for this yield gap include technical, socioeconomic, and organizational problems. Increase in food production in Sri Lanka will be achieved by cropping presently uncultivated agricultural land and by increasing cropping intensity. The development of high-yielding cultivars and production techniques for these varieties must receive more attention by research workers. The physical environment of each agroecological region is unique, so when formulating farming systems, great care is needed to match cropping patterns with each region.

AGLN activities in Sri Lanka were initiated in 1987. This report briefly discusses the effect of these activities on research and production of groundnut, pigeonpea, and chickpea in Sri Lanka.

Germplasm

During recent years, many AGLN crop varieties, representing a wide range of genotypic and phenotypic characteristics as well as resistance/tolerance to pests and diseases, were brought into the country through AGLN, and tested for their yield and adaptability. Some of the pigeonpea and groundnut varieties have shown tremendous yield potential and adaptability to local environments. Large-scale on-farm testing-cum-demonstrations of these varieties have already been carried out. Varieties selected for large-scale on-farm testing were ICGVs 86548, 86564, 86577, and 87151 for groundnut, and ICPLs 2, 87, and 161 for pigeonpea. For chickpea, more research is needed to select suitable varieties. Already, chickpea germplasm and many segregating F_3 and F_4 lines are being tested.

During 1990/91, about 900 pigeonpea germplasm accessions from ICRISAT were evaluated. These were planted at the Agricultural Research Station, Maha Illuppallama with the main objectives of screening for adaptability, ratoonability, resistance/tolerance to pod borers and podfly, and to diseases like macrophomina canker and yellow mosaic virus.

The major constraints to increasing legume production are the lack of pod-borer resistant lines in pigeonpea, non-availability of short-duration (75-80 days) pigeonpea lines, groundnut cultivars resistant to bud necrosis and high temperature, and excess moisture-tolerant chickpea lines. Future efforts should focus on these constraints.

Training

In the past Sri Lanka had the privilege of sending to ICRISAT trainees for in-service training courses, researchers on research fellowships, and scholars for masters and doctoral research. It is suggested that the number of training positions and training areas offered to Sri Lanka be further increased. In Jul 1990, a week long in-country training course on legume production was organized in Sri Lanka.

Future training needs of Sri Lanka include:

- More positions for in-service training courses such as food quality, legumes pathology
- Research and postdoctoral fellowships in physiology, microbiology, pathology, seed production, genetic resources, entomology, virology, postharvest technology, transfer of technology, crop improvement, and biotechnology
- Training for research station farm managers
- More research scholarships
- Funding for postgraduate students to register with Indian universities and do thesis research at ICRISAT

Information Transfer

The value of activities such as coordinators' and scientists' meetings, workshops, monitoring tours, and visits (to and from ICRISAT) is recognized. Further, the proceedings and

publications of these meetings are useful. Sri Lanka has been receiving invitations to attend such meetings.

Interaction among AGLN countries should be strengthened through study tours among member countries for researchers, extension staff, and administrators.

Translation of certain ICRISAT publications into the languages of member countries would be very useful. Support is also needed in the preparation of production pamphlets, statistical analyses, and documentation of AGLN activities in member countries.

Support to the National Research Program

AGLN review and work plan meetings provide a forum for local scientists to discuss their achievements and problems, and plan future activities. These meetings are useful and the development of a country work plan is appropriate. In some cases it may be advantageous to develop regional work plans to tackle common problems, such as setting up a working group for the pigeonpea pod borer complex.

Results of Collaborative Research

Many experiments were conducted on pigeonpea during the last two years. These concentrated on varietal evaluation, entomological studies, ratoonability, and time of planting. Results of these experiments indicate the following:

- Short-duration, photoperiod insensitive varieties produce one crop in Maha (Oct-Jan) and a second crop in Yala (Apr-Jun) with ratooning in Mar/Apr
- Pod borers are a major pest on pigeonpea, especially devastating if insecticides are not sprayed on determinate types. Thus, in minimal input systems, indeterminate varieties are essential
- Spraying methomyl at flower bud initiation followed by two more sprays at 10-day intervals gives good protection against pod borers

Based on these results, approximately 20 pigeonpea on-farm testing-cum- demonstrations were conducted on 0.1 ha plots during 1989/90 in one district. Results were promising as many farmers obtained yields of about 0.75-1.25 t ha*[1] with 3-4 insecticidal sprays. Many farmers preferred determinate types as they were easy to spray and labor costs at harvest were low.

During 1990/91, on-farm testing-cum-demonstrations in pigeonpea using three varieties, ICPLs 2, 87, and 161, have been extended to about 75 ha in three districts. ICRISAT provided 2 t of seed for this purpose.

Many confectionery groundnut varieties have been tested in Sri Lanka. Of these, five accessions looked promising, particularly in Mahaweli System B area in Polonnaruwa district where the crop is irrigated. These varieties produced over 3 t ha^{1} under experimental conditions. Seed was multiplied for large-scale on-farm testing during 1991 Yala (Apr-Jul)

Conclusion, Coordination, and AGLN's Ultimate Product

Since 1987, AGLN has provided support to Sri Lanka for pigeonpea, groundnut, and chickpea research in the form of training, equipment and supplies, visits by scientists, and activities on these crops. In Sep 1989 a special project for increasing pigeonpea production was started.

Thailand

Phaisal Supharngkasen

Khon Kaen Field Crops Research Centre, Khon Kaen

Introduction

Among the three ICRISAT grain legumes only groundnut is of importance to Thai agriculture. The total annual groundnut production ranged between 107 000 and 172 000 t over the past 10 years. A harvested area of 118 000 ha with an average yield of 1.39 t ha^{-1} were recorded during the 1988/89 crop season. The major growing areas are in the north, northeast, and central regions, with some groundnut in the south of the country. Groundnut is mainly grown by small-hold farmers. Almost all groundnut production is sole-cropped, with only a few farmers either rotating groundnut with rice in the dry season where irrigation is sufficient, or with other field crops in the rainy season. Intercropping is not accepted by farmers at present because of shading from the main crop and the poor competitive ability of groundnut, resulting in a drastic yield reduction in both the groundnut and the main crop.

Pigeonpea is primarily grown for lac culture in northern Thailand. It is also used as a green manure crop for arable land. As it is not a traditional crop, no statistics of pigeonpea cultivation have been collected in Thailand.

Extensive research on pigeonpea was conducted from 1978-1982 and funded by ACIAR.

Support for collaborative research on groundnut in Thailand during 1982-1989 has come from Peanut-CRSP and IDRC, with some input by ICRISAT. The Department of Agriculture (DOA), Kasetsart University (KU), and Khon Kaen University (KKU) are the participating research institutes. DOA and KKU have concentrated on yield capability, resistance to rust, leaf spot, and *Aspergillus flavus*, and earliness in northeast Thailand; KU has worked mainly on resistance to *A. flavus* and improving seed size in fertile soils in northeast Thailand. Work on postharvest and processing technology is carried out at KU.

Results of Collaborative Research

The international support given for research on groundnut has greatly assisted Thailand. Three groundnut cultivars, Khon Kaen 60-1 (high-yielding type from Moket), Khon Kaen 60-2 (boiling type from TMV-3), and Khon Kaen 60-3 (large-seeded type from NC 7), all developed by varietal selection, have been released during 1987 and 1988. These three lines have not been accepted as well as the three previously released varieties, Lampang, Sukothai 38, and Tainan 9 because they need intensive care at all stages of production, which farmers are not yet ready to give.

Many segregating progenies have been screened for resistance to A.flavus. Some lines with moderate resistance have been identified. Chemical control of leaf diseases and crown rot has been tried with some success. Studies on seasonal distribution of natural enemies of major groundnut pests and simulated defoliation to assess yield loss by leaf-feeding insects were made with a view to develop cheap and practical control measures.

Soil nutrient studies revealed that phosphorus and some minor elements were deficient in areas where groundnut is grown. The role of Rhizobium for improving groundnut yield and the effect of salinity on the nitrogen-fixing ability of Rhizobium were assessed.

Pigeonpea research in Thailand conducted from 1978-1982 involved collaborative research with ICRISAT. The subsequent ACIAR project from 1983-1988, in which ICRISAT participated, continued research into improving pigeonpea. Most studies concentrated on the evaluation of production systems and genetic material.

Through the trials supported by ACIAR and ICRISAT, nine varieties, QPLs 17, 42, 58, and 130, Hunt, ICP 8324, ICPLs 151, 83009, and 86008, have been identified as performing well in Thailand. The varieties yielded from 1.66-1.87 t ha^{-1}.

Although pigeonpea has relatively little potential for gaining acceptance as human food in Thailand, it is becoming common to use the legume in rotation with sugarcane for green manure in northeast Thailand.

Training

Since 1974, 23 Thai scientists have been trained at ICRISAT. Of these, one received a research scholarship, and 22 received in-service fellowships. On their return these participants showed improved job performance in grain legumes research.

Future Prospects for AGLN Grain Legumes

We are expecting support from Peanut CRSP for another five-year program. Therefore, research on breeding for high yield, resistance to A.flavus, leaf spot, and crown rot, along with work on agronomic practices and economics of pesticide application should continue. With the termination of funds from ACIAR, pigeonpea work has been restricted to testing some developed lines and producing limited seed for farmers, mainly for growing green manure crops.

Poor yields of groundnut is generally due to poor cultural management, high pest infestation, and low soil fertility. Other production constraints are A. flavus, stem rot, crown rot, and drought. Genotypes tolerant to these factors should be imported from international organizations and tested in Thailand, In addition, sources of information on groundnut research, such as newsletters and journals, should be provided to enable Thai scientists broaden their knowledge.

Technologies for producing pigeonpea in Thailand which have come from research with ACIAR and ICRISAT are relatively well developed. This means that the crop can be grown much more widely than at present. The major limiting factors to wider acceptance of pigeonpea is the farmers' lack of familiarity with its utilization and the absence of demand in the domestic market. More research and education is therefore needed on the utilization of pigeonpea for human food and animal feed and fodder.

Vietnam

Ngo The Dan and Pham Van Bien

Ministry of Agriculture and Food Industry, Hanoi
and Institute of Agricultural Science, Ho Chi Minh City

Introduction

Food legumes play a very important role in Vietnam's agricultural production and are being cultivated on over 600 000 ha. Among the AGLN crops, groundnut is the most important and is cultivated on about 300 000 ha in both North and South Vietnam. Productivity of groundnut pods has recently increased to about 1.0 t ha^{-1}. The main constraints in groundnut production are the low yield of traditional varieties, excessive vegetative growth resulting in lodging, drought, low inputs, insect pests, and diseases.

Germplasm

Vietnam has received valuable germplasm since 1987, with a total of 346 entries in 18 groundnut trials and 220 entries in 11 pigeonpea trials. Material has always arrived on time and in good condition. Difficulties faced include lack of trained groundnut and pigeonpea researchers, literature about the agronomic package for these crops, and funds for conducting and monitoring these trials.

Cultivation of pigeonpea and chickpea in farmers' fields has yet to start, but there are potential areas for growing these crops and suitable cropping systems exist into which

these crops can fit; Drought-tolerant pigeonpea can be grown in the hilly areas as a cover crop or as a reforestation crop in degraded hilly areas and wastelands. Extra-short duration pigeonpea can be also grown in intensive cropping systems in upland areas.

Since 1987 Vietnam has received ICRISAT's assistance to promote research and production of groundnut and pigeonpea. On 25 Sep 1989, ICRISAT and Vietnam's Ministry of Agriculture and Food Industry (MAFI) signed a MOU that provided an opportunity for Vietnam to become part of AGLN, receive support and assistance in agricultural research from ICRISAT, and interact with other member countries in the region that are part of the AGLN,

Training

Thirteen Vietnamese research workers have received training at ICRISAT. Although the number is not large, it has met part of our research needs and program objectives. Most trainees have demonstrated considerable improvement in their research work. We would like ICRISAT to maintain the number of in-service training slots, increase positions for postdoctoral fellows and research fellows, and organize in-country training courses and special courses on legume breeding, pathology, entomology, and legume cropping systems.

Information Transfer

During the last three years, travel of ICRISAT scientists to Vietnam has helped to link research activities, and facilitated exchange of information between Vietnam and ICRISAT. The frequency of travel should be increased for review and planning meetings and monitoring tours associated with the national research program. The AGLOR planning meetings in which Vietnamese scientists took part have been very useful for our research program.

Publications from ICRISAT have been very useful to Vietnamese scientists because literature on the AGLN crops available in Vietnam is limited. There is a need to establish a close link between Information Services of ICRISAT and the library units of the National Institute of Agricultural Science (INSA) and Institute of Agricultural Science (IAS) of South Vietnam.

During the first three years of collaboration between ICRISAT and Vietnam, the food legume research program of the country received very effective assistance from AGLN/ICRISAT.With this help our ability to conduct research work in groundnut and pigeonpea has improved We now wish to form a groundnut and pigeonpea research network to link different centers throughout Vietnam.

AGLOR was started in early 1990 with the help of AGLN, The ICRISAT groundnut varieties with high yield, resistance to insect pests and diseases, and tolerance to drought are being multiplied for release to farmers. New groundnut varieties along with modified cultural technology are being tested on farmers' fields.

Results of Collaborative Research

Eighteen trials of groundnut and 11 trials of pigeonpea have been conducted since 1987 covering North, South, and Central Vietnam. ICRISAT's early groundnut lines, ICGVs 86015, 86143, 87045, 87051, and 87055 produced 2.8-3.0 t pods ha^{-1}, while the local control varieties yielded 0.4-0.7 t ha^{1}. The new lines were resistant to rust, late leaf spot, and lodging. Other lines, such as ICGSs 1, 35 and 44, gave a pod yield of 2.8-2.91 ha^{-1} and had high to moderate resistance to foliar diseases. In Central Vietnam, two lines, ICGVs 86045 and 86053, yielded 1.6-1.9 t ha^{1} compared to 0.5-0.8 t ha^{-1} for local lines. Some medium and late groundnut lines such as ICGVs 87132 and 87157 gave stable pod yields producing 3.0-3.2 t ha^{*1} over three years (1988-1990). They had greater foliar disease resistance, larger seed, and more seeds per pod than the local varieties. Some of these groundnut lines have been used in the national breeding program.

Since 1988, nine trials of EXPIT and EPIT containing 64 pigeonpea lines were received. In 1989/90, seeds of 10 lines were received for adaptive trials. Fourteen pigeonpea trials were conducted in 1990 at eight locations differing in climate and soil type. Preliminary results showed that pigeonpea was widely adapted to the differing climatic conditions of North and South Vietnam. The dryland areas in the central highlands of Vietnam (Thuan Hai province) seemed the area most suitable for growing pigeonpea. Pigeonpea lines ICPLs 84023, 85012, 85015, and 86008 yielded 1.5-2.0 t $ha-^{1}$ in the north, while ICPLs 87, 151, 84031, and 85015 were more promising for the south. High humidity conditions in the south may have caused the low rate of pod set. Losses caused by insect pests such as podfly, lima bean pod borer, and Helicoverpa pod borer were also large.

In future, we will need help and financial support from ICRISAT in all aspects of the AGLN's activities, especially in collaborative research, training, and exchange of information.

ICRISAT REPORTS

Groundnut Research at ICRISAT as Related to Asia

J. A. Wightman and S. N. Nigam

Legumes Program

Introduction

This paper is an overview of the activities of the Groundnut Group at ICRISAT since our meeting in 1988 which have had the most impact on helping the NARSs promote groundnut production in Asia, Considering the small size of our Group, our contact time and activity in Asia has been at a high level over the last two years. We consider ourselves still to be at the stage of defining constraints; so there is still a need to collect more information about how much yield loss can be attributed, in absolute terms, to the different constraints. But first, some words about the Group personel at ICRISAT Center.

The Groundnut Group is divided into six discipline units; all but the Breeding Unit has multicrop responsibilities; In addition, we function as part of AGLN and LEGOFTEN.

The scientific staff most concerned with groundnut are (Unit Leader first):

Breeding: S.N. Nigam, L J. Reddy, and S.L. Dwivedi

Cell Biology: LP. Moss and D.C. Shastri

Entomology: J.A. Wightman (currently Groundnut Group Leader) and G.V. Ranga Rao

Pathology: D.H. Smith, V,K. Mehan, and S.B. Sharma

Physiology: C. Johansen, R.C. Nageswara Rao (on sabbatic), and V.M. Ramraj

Virology: D.V.R. Reddy

LEGOFTEN: C.S. Pawar

This represents a depletion in research staff since we last met: D. McDonald is now Legumes Program Director, Resignations have come from Breeder M. J. Vasudeva Rao, Cell Biologist P. T. C. Nambiar, and LEGOFTEN Coordinator P. W. Amin, A. K. Singh

was transferred from Cell Biology to the Genetic Resources Unit to replace V. Ramanatha Rao who went to IBPGR, Rome. J. H. Williams (Principal Physiologist) and F. Waliyar (Principal Pathologist) were transferred to ISC, Niger, West Africa and P. Subrahmaniam to Malawi as Principal Pathologist. S. N. Nigam completed a one-year sabbatic assignment in North Carolina in 1990. We welcome Don Smith from Texas as Principal Legumes Pathologist.

Other administrative changes include the formation of a discrete Virology Unit and the change in name of the Cytogenetics Unit to Legumes Cell Biology to cover a broadening of responsibilities.

Activities in Asia

The most significant activity in Asia was the Groundnut Scientists' Meeting held in Malang, Indonesia, Nov 1988. Scientists from eight national programs in Asia and representatives of a range of multilateral and bilateral international research organisations met to discuss priorities. The results of this discussion have lead to changes in emphasis in the research program at ICRISAT, of Peanut CRSP, and ACIAR. The general consensus was for ICRISAT to supply 'finished' lines preadapted to conditions of the agroecological zones of each country. The minority of countries wanted segregating populations from which to select their own varieties or breeding material. The other main conclusions were the need for more input into entomological research, particularly pest surveys, and studies of methods to overcome the problems created by shading and acid soils. The last three topics were discussed in detail at a workshop hosted by the Philippine National Program in Los Banos in Apr 1990. The workshop was attended by representatives from other Asian countries, as well as Peanut CRSP, ACIAR, and ICRISAT.

The Agroclimatology Workshop that was held at ICRISAT Center in Dec 1988 also modified the research approach of the Groundnut Group. A subsequent visit by a consultant from Canada gave us additional information about how we can become more effective in our support of Asian NARSs through a GIS. We await the installation of a GIS and the initiation of constraint (pest and disease) surveys in Asia to help us integrate our knowledge about the problems of the region as a whole.

New contacts have been made and consolidated in Asia as a result of training courses, traveling workshops, and constraint analysis missions, for example, in Bangladesh, Myanmar, the People's Republic of China, Vietnam, and Taiwan. This has been achieved without losing contact with long-standing 'core' cooperators. We look forward to investigating further the possibility of increasing our ability to support groundnut production in Malaysia, Cambodia, and perhaps Bhutan.

A meeting in Jan 1990 between representatives of the ICAR, AICORPO, the (Indian) National Research Centre for Groundnut (NRCG), and ICRISAT groundnut scientists established a series ofjoint projects that are being carried out at ICRISAT Center and at a number of research institutes in our host country. This allows us to test management procedures, germplasm, and breeder material in a number of environments, the results of which may be transferred to similar situations in other parts of Asia.

Some Constraint-Orientated Activities

Peanut stripe virus is the cause of concern across Asia because of the ease of its spread via infected seed- The second major workshop dedicated to this disease was held at ICRISAT Center in Aug 1989 to allow 39 experts to discuss, among many other topics, ways of containing this refractory disease. A pleasing international note was a report presented at this workshop by a Thai virologist of the research he carried out in France that was funded by IDRC, the French, and ICRISAT.

Approximately 9000 groundnut genotypes were screened for resistance to this disease in an Indonesia ACIAR-ICRISAT project. Unfortunately, no resistance was detected. Experiments on its epidemiology and economic importance continue in Indonesia to identify alternative methods to control this disease.

The base for managing this disease has been expanded by sending aphid (vector) resistant germplasm to countries where this disease is endemic, to evaluate its performance under high infestation pressure.

Another working group to promote research on bacterial wilt of groundnut was formed at a meeting in Malaysia in 1990. Scientists from Australia, UK, USA, and Malaysia agreed to form an informal network with scientists from countries where this disease is endemic with the objective of stimulating research on the hosts, virulence, pathogenicity, and characteristics of its varied pathotypes, its epidemiology, and its management. This activity is orientated towards the needs of groundnut growers of the People's Republic of China, and of Indonesia.

Although not a constraint in the normal sense, the mycotoxins produced by Aspergillus flavus are of particular concern to national programs that encourage international trade in groundnut and groundnut products, including the cake that remains after oil extraction. A workshop was held at ICRISAT Center to promote the exchange of information on all aspects of aflatoxin-related problems. Full proceedings of this workshop are available.

A training course on virological techniques was held in the People's Republic of China, following visits by senior scientists from ICRISAT earlier this year. There has been an increase in interchange between this important groundnut-growing country and ICRISAT in recent years. We have been particularly pleased to welcome young scientists from China to the Cell Biology Unit where they have made an excellent impression in terms of their dedication, diligence, and the high quality of their work.

Unit Activities

It is not possible to summarize all the activities of the Groundnut Group over the last two years but some highlights are mentioned here. Further details can be found in the ICRISAT annual reports for 1988 and 1989 and in other publications available to you.

Breeding Unit. A number of ICRISAT selections have been tested extensively by Indian national program scientists in different agroecological zones of their country. Outstanding among these, in terms of yield, adaptability, and we hope in sustainability, are ICGSs 11

and 44. These are in great demand by farmers throughout the country. Other lines that are talked about in positive terms in India are ICGSs 1, 5, 21, and 76, and FDRSs 4 and 11. FDRS 4 is of particular interest because it combines disease- and insect-resistance with good agronomic features. Elsewhere in South Asia, Pakistan has released as BARD 699 a composite of ICGVs 87187 and 87128 for rainfed cultivation. A selection from ICGV 87127 (ICGS 35) has been released as Jinpungtangkong in the Republic of Korea because of its high yield, its protein and oil content, and the favorable quality of its oil.

The international nurseries and trials provide early, medium-late, disease-resistant, pest-resistant, confectionery, and drought-resistant lines for testing in the appropriate zones of cooperating countries. The trials have contained lines that can provide desirable varieties or germplasm to the countries that have tested them.

Plant protection. The pathologists have completed screening the germplasm for resistance to late leaf spot and rust. More than 200 accessions have been identified with resistance to one or both of these diseases and some have already been used successfully in the breeding program. The entomologists are now screening the same 200+ lines for resistance to defoliating and sucking insects in a continuing quest for groundnut germplasm with multiple resistance.

Early leaf spot remains a disease for which we have found no strong resistance in cultivated groundnut. High levels of resistance to this disease, however, have been found in wild species, and progress is being made in transferring the resistance genes to adapted varieties.

The entomologists have entered a cooperative program with Indian national program scientists to find resistance to soil insects with particular emphasis on white grubs. This group of insects infest the groundnut crop more severely in several Asian countries than had hitherto been realized. Field experiments at ICRISAT Center have shown that several wild species have resistance to jewel beetle, another kind of soil insect that attacks roots. Seed has been sent to the Coordinator of the All India Coordinated White Grub Programme for testing in north India for resistance to white grubs during the 1990/91 postrainy season.

Observations and experiments on the causes of insect outbreaks point clearly to excess insecticide application and drought stress as being major contributors. Reducing spray application is a matter of raising farmer awareness about the hazards of applying insecticides except when really needed. This problem is common to a number of crops in Asia. The linkage of drought stress with pest outbreaks vindicates our adoption of a multidisciplinary approach to relieving constraints to production.

The entomologists have tested a number of breeder's lines in farmers' fields for resistance to defoliators and sucking pests. We are impressed by the all-round performance of these resistant lines in the hot spots where they were tested, and welcome the opportunity to find out how well they perform under intense pest pressure in other zones. The entomologists have also decided that the ICRISAT farm is not the best place to screen for resistance to pests and would like to continue this process as a collaborative exercise with other entomologists in Asia, besides India.

The relationships between the level of Spodoptera, groundnut leaf miner, jassid activity, and yield can be explained. For Spodoptera, we can relate damage to the numbers of male

moths caught in pheromone traps several weeks earlier. Much of the foundation research linking tomato spotted wilt virus and its thrips vectors with the varied symptoms of bud necrosis disease was carried out at ICRISAT. This work is now being continued in two areas. A visiting researcher from Holland is studying resistance to this virus (joint project of the Breeding and Virology Units) and a research scholar from India is carrying out a detailed study of the disease's thrips vector (joint project of the Entomology and Virology Units). We anticipate the need to extend this study to other parts of Asia because there may be more than one vector and several distinct isolates of this disease.

Abiotic constraints. Many of the lines selected for resistance to biotic constraints have poor pod yields in long day conditions because a disproportionate amount of the photosynthate is diverted to the haulms. This recently discovered photosensitivity may explain, at least in part, why some genotypes are resistant to diseases at one location but not at another. We hope our research will help us understand the phenomenon better and eliminate or reduce its influence in our breeding material.

Drought tolerance is of prime concern to many groundnut growers. The search for resistance continues under the line-source screening at ICRISAT Center. Subsequent testing is to take place in a rain shadow area (Anantapur) south of Hyderabad. A number of varieties are now known to tolerate drought stress and are available for evaluation outside India. The mechanism of drought stress recovery is being tested so as to develop a lab-based screening procedure.

Conclusion

This has been a brief overview of the activities of the Groundnut Group as they relate to Asia. We hope that it is clear that our numbers are small, in fact much smaller than the number of groundnut scientists in many NARSs, that we have responsibilities outside the Asian region, and that we are based in an environment that is different to most of those obtaining in Southeast Asia, yet we plan our activities with the needs of Asia as a whole in mind. The next phase of our work will contain adaptive on-farm research; this will be the real test of the applicability of our work.

Chickpea Research at ICRISAT as Related to Asia

Jagdish Kumar

Legumes Program

Introduction

Chickpea research at ICRISAT continues to enhance the capabilities of national programs to increase the productivity and stability of chickpea production by genetic and management improvements. The Genetic Resources Unit (GRU), the Resource Management Program (RMP), the Crop Quality Unit (CQU), and various disciplines of the Legumes Program at ICRISAT jointly contribute towards these goals. ICRISAT and ICARDA collaborate with a number of Asian countries on chickpea research. Links are being developed with more countries with the potential to grow chickpea, such as the People's Republic of China and the USSR. Dr Johansen discussed important developments on chickpea research at the Regional Legumes Coordinators' Meeting at ICRISAT Center in Dec 1988. Therefore, this presentation will focus only on the important research findings during the last two years.

Chickpea in the Nineties

Global chickpea research in the eighties was discussed in detail in Dec 1989 at the Second International Workshop on Chickpea Improvement at ICRISAT Center. Eighty nine chickpea scientists from 29 countries participated and formulated recommendations for global research in the nineties. The workshop recommended increased efforts to stabilize chickpea yields by incorporating resistances to important biotic and abiotic stresses. Ideotypes for drought, higher latitudes, and high input systems were suggested. It was pointed out that to increase gains from selection, wider variability should be included in making crosses. Basic research to understand the physiology and genetics of chickpea was emphasized. As these recommendations have relevance for chickpea research in Asia which accounts for about 90% of world chickpea production, we are making efforts to incorporate them in our plans.

Chickpea research at ICRISAT was reviewed in Sep 1990 by a CGIAR external program review panel. The panel reported that the Institute's chickpea research program was moving in the right direction and achieving the desired goals. They recommended that more emphasis be laid on strategic and upstream research at ICRISAT and that NARSs be given a greater role in applied research.

The biotic and abiotic constraints to chickpea production are identified in Table 1.The progress in alleviating some of these is detailed:

Table 1. Constraints to chickpea production in different zones of the world.

Constraints	Zones ("latitude)				
	0-20	20-25	25-30	30-45	
Biotic					
Fusarium wilt	2-1*	2-1	2-1	3	
Ascochyta blight	-	-	6	1	
Botrytis gray mold	-	5	3	-	
Root rots	3	3	5	4	
Stunt	4	4	4	5	
Helicoverpa	1-2	1-2	1-2	6	
Leaf miner	-	-	-	2	
Abiotic				Spring	Winter
Drought	1	1	1	1	-
Salinity	3	3	2	-	-
Excessive moisture	-	4	5	-	2
High temperature	2	2	4	2	-
Low temperature	-	-	3	-	1

* 1-9 scale where 1 is most important and 9 is least important
\- Not a constraint

Biotic Stresses

Ascochyta blight. To enhance resistance to ascochyta blight, multiple crosses have been made at ICRISAT among known tolerant lines. The parents used were NEC 138-2, ICC 1903, C 235, ILC 92, ILC 202, and ILC 3279. Screening of segregants in a growth room at ICRISAT Center has given selections with better resistance than the parents. These efforts are continuing.

Botrytis gray mold. Botrytis gray mold can be a serious threat to chickpea production especially in Bangladesh, parts of Nepal, and in northeastern India. A high level of resistance to this disease has not been observed so far, and efforts are being made to manage this disease by using tall and erect genotypes. Genetic enhancement of resistance may be possible by making crosses among tolerant lines and subsequent selection among segregants under appropriate disease pressure. Some breeding lines like K 850 X Dhanush, ICCL 86247, and ICCL 87322 have shown the most tolerance in epidemic situations.

Pests. Progress has also been made in breeding for Helicoverpa armigera (pod borer) resistance using a program similar to that for enhancing resistance to ascochyta blight; In

the meantime the linkage between resistance to pod borer and susceptibility to fusarium wilt has been broken, and a number of lines including ICCL 86111 now combine the two resistances. Also, various components of integrated pest management are being tested in farmers' fields to reduce damage by insects.

The first consultative group meeting on the host selection behavior of H. armigera was organized at ICRISAT Center, 5-7 Mar 1990.

Abiotic Stresses

Concepts of functional ideotypes for particular environments were proposed for drought stress, high latitudes, and high input situations.

Drought tolerance. Drought is perhaps the most important abiotic stress limiting chickpea productivity. Sources of drought tolerance were identified, segregating populations were screened, and selections combining drought tolerance with good yield have been made in the cross ((Annigeri X ICC 4958) X ICC 12237). Other sources, ICC 10448 and ICC 4951, have also been used in crosses. ICC 4958 has a longer and more voluminous root system than most other lines, which seems to be related to its drought tolerance. Its large seed and the double-podded character appear to confer it greater sink strength at basal nodes. These findings are likely to enhance stability of performance in drought environments where chickpea is generally grown.

The extra-short duration kabuli line, ICCV 2, escapes terminal drought because of its early maturity. Two desi lines ICCVs 88201 and 88202 of similar durations have been bred and are under yield tests.

Temperature tolerance. Temperatures 30°C during podding are harmful to chickpea. Screening for high temperature tolerance done by sowing in Jan has resulted in genotypes which produced yields of over 1.5 t ha^{-1}. This also showed that lines such as ICCV 2 could be planted as late as Jan under conditions obtaining at ICRISAT Center, giving farmers more options for growing this crop.

Chickpea does not normally set pods under extreme cold conditions. Screening germplasm and breeding materials at Hisar identified a few F_3 plants that did form pods at low temperatures. Other low temperature selections, ICCV 88512, and CTS 30521 and 10886, are also early maturing lines and therefore, escape foliar diseases and pod borer attack. More work is being done on these lines.

Release of Cultivars and Performance of Elite Lines

Kabuli chickpea cultivation was extended to peninsular India in 1989 when ICCV 2, an extra short-duration, wilt-resistant kabuli cultivar, was released as Swetha in Andhra Pradesh, India. ICCC 37, a desi line, was also released as Kranti at the same time. ICCC 32, a wilt-resistant kabuli line, and ICCL 82108, a wilt-resistant double-podded desi line,

were released in Nepal this year. ICCV 2 is in demand outside Andhra Pradesh, especially in Maharashtra State of India, and in Myanmar. ICCV 10, a wilt-resistant desi cultivar, appears to have wide adaptability, doing very well in India and Bangladesh (as ICCL 83228). Similarly, the performance of ICCLs 83007, 83008, 83103, 83105, 83107, and 83228 in Bangladesh and ICCL 86237 in Nepal have been very promising. Some of these lines may be released in the near future.

Working Groups

Two working groups, one on ascochyta blight (in cooperation with ICARDA) and another on botrytis gray mold, are being organized to focus research on these diseases. It is hoped that this development will help in the breeding of chickpea lines with enhanced resistance to these important diseases.

Chickpea in the Indian Subcontinent

Chickpea is the most important pulse crop in the Indian subcontinent and therefore, countries in the region, notably India, Pakistan, Bangladesh, Nepal, and Myanmar are making efforts to increase productivity of this pulse through crop improvement, and by finding special niches in various rotations to fit this crop. These efforts have been described recently in the Second National Workshop on Pulses in Bangladesh held 6-8 Jun 1989. Two examples being the efforts to introduce chickpea into the Barind area of Bangladesh, and the delta region of Myanmar.

Future Prospects

The increased demand for chickpea as a high protein and health food is worldwide. As nearly 90% of chickpea is grown as a rainfed crop, more efforts are needed to increase and stabilize productivity under drought. At the same time, chickpea production should be extended to areas where it has a comparative advantage. Basic research to understand the genetics and physiology of various traits through conventional and molecular methods should be strengthened to widen the genetic base for improving this crop. Long- and medium-duration chickpea show high yield potential, but this potential is rarely achieved mainly because of end of season abiotic and biotic constraints. Attempts to reduce the maturity duration of the crop in different regions are being made to avoid the risks to higher productivity. In the meantime, efforts to develop cultivars with tolerance or resistance to different abiotic and biotic stresses will continue.

Pigeonpea Research at ICRISAT as Related to Asia

R.P. Ariyanayagam, C. Johansen, M.V. Reddy, S.S. Lateef, C.K. Ong, and S.B. Sharma

Legumes and Resource Management Programs

Introduction

An overview of ICRISAT's pigeonpea improvement program and its achievements was presented at the meeting of coordinators in 1988. Following that meeting, collaborative research and developmental efforts aimed at improving pigeonpea production technology were stepped up in several of the network countries. These attempts are progressing well.

This paper highlights some recent achievements of our Programs, the results of joint research in the network countries, and indicates some possible areas for future network collaboration.

Recent Achievements

Short-duration pigeonpea. Early this year the first short-duration hybrid pigeonpea, ICPH 8, was identified for release in India. It has shown a yield advantage of 40-50% over existing varieties and possesses good yield stability.

Our efforts to breed phytophthora blight, sterility mosaic disease and wilt-resistant extra-short-duration (ESD) and short-duration (SD) pigeonpea are progressing well. We now have SM and wilt-resistant SD lines. Early generations of SD and ESD pigeonpea have shown field tolerance to phytophthora blight.

New plant types, such as ESD indeterminate, SD and ESD compact dwarfs, SD determinate vegetable types, and annual habit, have been recently identified.

The response of the newly evolved ESD lines differing in canopy characteristics to plant population and sowing date in different environments has helped us determine optimum agronomic requirements of these genotypes, The genotype x environment response of a wide range of ESD genotypes indicate that ESD cultivars that mature in 90 days can compete with other SD legumes such as cowpea and mung bean in situations where soil water availability may be low.

SD genotypes such as ICPL 86012 have been identified with better ratoonability than ICPL 87. Members of this group were found most sensitive to drought stress during the flowering and early pod-filling period. Deep rooting habit, indeterminancy, and the ability to retain leaves during drought, conferred drought resistance. SD pigeonpea has residual benefits on the subsequent crop. Waterlogging effects have been quantified in terms of

reduced soil oxygen concentration. Yield reduction with delayed sowings can to some extent be attributed to waterlogging.

During 1989,25 SD pigeonpea replicated yield trials and 130 advanced promising lines were supplied to 10 Asian countries. All but one country shared their data from these tests with us. Grain yield exceeded 1.0 t ha^{-1} at one or more locations in most countries. In Indonesia, yields were very poor, and this may have been due to low biomass accumulation as suggested by the short time to maturity, and to pest damage. Perhaps adjusting the planting time to achieve appropriate vegetative growth may help improve yields in Indonesia. In general, the top two lines were location- and country- specific. However, a few of them performed well at either more than one location within a country, or in more than one country. For instance, ICPL 84037 performed well in all the four test locations in Myanmar; ICPLs 83006, 86005, 83015, and 87105 were among the top two yielders in two countries.

Medium- and long-duration pigeonpea. In the medium-duration (MD) group, combined resistance to SM and wilt, as well as individual resistance to each of these two diseases have been bred. We have also bred tolerance to the pod borer, Helicoverpa armigera.

For the long-duration (LD) group, SM and podfly resistances have been incorporated.

MD and LD lines were evaluated in replicated tests at three locations in Nepal. Additionally, improved lines were tested in Sri Lanka, Vietnam, and Myanmar. Although yields were not particularly high for the MD cultivars, probably due to pod borer and podfly damage, the ICRISAT lines generally performed better than the control cultivars.

Perennial Pigeonpea in Agroforestry Systems

If farmers in the semi-arid tropics are to adopt agroforestry on a wide scale, researchers must address two major problems. One is the possibility of competition between trees and field crops in environments where moisture and soil fertility are likely to be limiting. The second is the considerable delay before farmers can expect any economic return from trees.

In response to these problems, fast-growing short-lived woody species such as pigeonpea have been examined at ICRISAT Center. Pigeonpea is a truly multipurpose species. It provides food, fuelwood, fodder, and shelter material to subsistence farmers. It is already widely grown as a food crop in South Asia and other parts of the world, and its leaves are readily accepted as livestock fodder. Promising perennial lines, such as ICP 8094, which are suitable for long-term cultivation have been identified as they combine disease resistance with excellent agronomic traits. These lines are particularly suited for soils which are shallow, stony, and low in fertility, common features of degraded, marginal land that is too risky for regular cropping.

The main advantage of perennial pigeonpea is the ability of roots to grow over a long period so that they can penetrate deeper than the roots of annual crops. Furthermore, perennial pigeonpea is slow maturing and regrows well after regular cropping. Erect

branching lines which are less competitive with annual crops, or bushy types with high fodder potentials have been identified. Results from both Alfisols and Vertisols have shown that annual production of 6-8 t ha^{-1} of wood, 5-6 t ha^{-1} of fodder during the dry season, and 1-2 t ha^{-1} of grain are possible under rainfed conditions.

Germplasm Collection

During 1989/90,152 germplasm accessions were collected in A G L N countries of which 89 were from India, 36 from Indonesia, 2 from Myanmar, 1 from the Philippines, and 24 from Thailand.

Mineral Nutrition

Phosphorus (P) acquisition by pigeonpea was studied under a special project funded by the Government of Japan. The root exudate piscidic acid and its derivatives were shown to release P from iron-bound forms in the soil. This may provide an explanation for the lack of responsiveness to added P by pigeonpea in iron-rich soils. Results of this study, and others relating to soil aeration, root system quantification, and intercropping effects, were presented in an international workshop on Phosphorous Nutrition of Grain Legumes in the Semi-Arid Tropics, held at ICRISAT Center in Jan 1990.

The F_1 generation of Cajanus cajan x Atylosia albicans was found to be as salt tolerant as its tolerant parent, A. albicans. Thus salt tolerance appears to be dominantly inherited.

Pests and Diseases

The pod borer, Helicoverpa armigera, was the most damaging pest on all maturity groups, across A G L N countries. The spotted borer, Maruca testulalis, usually a pest of SD pigeonpea in northern India, is apparently taking hold of SD pigeonpea in central and southern India. The pest is also widespread in Sri Lanka and Myanmar. The podfly, Melanagromyza obtusa, is particularly damaging in MD and LD pigeonpea.

The first MD Helicoverpa-tolcmnt cultivar, ICPL 332, was released in Andhra Pradesh, India in 1989. Host plant tolerance to borers has been identified in SD, MD, and LD groups but not in ESD pigeonpea.

International pigeonpea pests resistance nurseries (IPPRN) of SD, MD, and LD groups were sent for 24 tests in Indonesia and 20 in India. In addition, 43 promising selections were sent to Indian scientists and 10 to Pakistan. ICRISAT entomologists are involving farmers in India in the evaluation of pest-resistant genetic materials under resource poor conditions. Pod borer-tolerant germplasm maintained their resistance and yield superiority in tests carried out in Myanmar, Indonesia, India, and Sri Lanka.

Nematodes

Major nematode problems have been identified on the basis of a questionnaire survey of nematologists and plant protection scientists. Root knot (Meloidogyne spp.), root lesion (Pratylenchus spp.), reniform (Rotylenchulus reniformis), and cyst (Heterodera cajani spp.) nematodes cause problems- The survey did not include South Asia and no information is available for this region on problems caused by nematodes.

We have initiated preliminary surveys in Nepal and hope this could be gradually extended to the major pigeonpea-growing countries of the region.

We have standardized host plant resistance screening techniques for identifying sources of resistances to the reniform, cyst, and the root knot nematodes. Sources of resistances to root knot nematode, such as ICPs 11289, and 11299, have been identified.

Diseases

Stem canker/root rot caused by Macrophomina phaseolina (Rhizoctonia bataticola) was found to be a widespread disease affecting pigeonpea in Nepal, Myanmar, Sri Lanka, and India. A program to identify sources of resistance to the disease was initiated at ICRISAT Center in 1988, SD lines such as ICPLs 86005 and 87105 that were found promising at the Center, are being evaluated in Nepal, Myanmar, Sri Lanka, and India. In collaboration with Andhra Pradesh Agricultural University (APAU) further screening of germplasm has been undertaken during 1990/91 at Madhira in Andhra Pradesh, a 'hot-spot' location for the disease. More than 200 pigeonpea lines found resistant to different diseases at ICRISAT Center have been sent to Sri Lanka for evaluation against stem canker. ICPL 366, a sterility mosaic resistant LD cultivar, was found to be susceptible to stem canker in Nepal.

An experiment to determine the strain situation in sterility mosaic pathogen and its mite vector in Nepal in relation to India is in progress. The results obtained so far in India indicate strain differences for SM.

A preliminary disease survey undertaken in Myanmar in 1989 reported low incidence of both fusarium wilt and sterility mosaic. The reason for this low incidence needs to be investigated. At Mahlaing farm in Mandalay division, where there was heavy incidence of SM in pigeonpea trials in 1989, the local cultivars suffered less than many introduced genotypes. ICPL 366 and a few other cultivars resistant to SM in India were also found resistant to SM in Myanmar, which suggests strain similarities for the two countries.

Germplasm screening at ICRISAT Center and several other locations in India identified KPBR-80-2-1 which, besides being resistant to fusarium wilt and sterility mosaic disease, showed resistance to phytophthora blight. This line will be tested in other countries as well.

Seed dressing followed by two foliar sprays with ridomil at 15-day intervals after sowing provided effective control for phytophthora blight in susceptible SD pigeonpea since susceptibility to phytophthora blight decreased after the plants were 45 days old.

Future AGLN Collaboration

Replicated yield trials. Replicated yield trials of the following maturity durations will be available in 1991:

- Two sets of ESD trials designated EXPIT 91 determinate type (DT) and EXPIT 91 indeterminate type (NDT); their maturity duration is less than 110 days at Patancheru
- Two sets of SD genotypes designated EPIT 91 DT and EPIT 91 NDT; their maturity duration ranges 111-135 days at Patancheru
- Medium-duration Pigeonpea International Trial (MPIT) genotypes that mature in 140-160 days at Patancheru
- Long-duration genotypes that mature in more than 180 days at Patancheru

Germplasm

- Perennial pigeonpea germplasm for suitable AGLN environments
- Hybrid pigeonpea that can be developed using male sterile lines and male parents of different maturity durations which are available at ICRISAT

Nurseries

- International Pigeonpea Pest Resistant Nurseries consisting of resistant cultivars and susceptible checks can be provided for assessing pest reactions in different agroclimatic zones
- Pod borer- and podfly-resistant selections and bred lines of all maturity durations are available for multilocational testing
- International Pigeonpea Multiple Disease Nursery (IPMDN) comprising lines resistant to single and multiple diseases will be available

Collaborative activities

The following activities can be considered with AGLN:

- Germplasm collections for such countries as Malaysia, Vietnam, the People's Republic of China, Taiwan, Indonesia, and the Philippines from where only a few accessions exist in the collection at ICRISAT
- G x E analysis to determine factors affecting adaptation of pigeonpea.
- Constraint analysis of physical, environmental factors, for new pigeonpea areas
- Integrated pest management projects and programs
- Systematic surveys to estimate the losses caused by Macrophomina phaseolina stem canker as well as for other diseases and pests
- Training in breeding, agronomy/physiology, and pest and disease management at ICRISAT

Resource Management Program Research as Related to Asia

J.L. Monteith and S.M. Virmani

Resource Management Program

Mandate

ICRISAT's mandate has two components relating specifically to the Resource Management Program (RMP) as distinct from the crop improvement programs.

- Identify constraints to agricultural development in the semi-arid tropics and evaluate means of alleviating them through technological and institutional change.
- Develop improved farming systems that will help to increase and stabilize agricultural production through more effective use of natural and human resources in the SAT. Few of the terms in this mandate need comment.

Farming systems. As far as experimental work is concerned, "cropping systems" would be more appropriate as ICRISAT does not have a mandate to work with animals.

Increase and stabilize. We would now add "sustain natural resources" for which three categories are distinguishable: replaced (sunlight, rain); replaceable (nutrients); and irreplaceable (soil). We recognize that the demand for basic resources (water, energy) is rapidly increasing with major implications for agricultural production.

Human resources. Examples are: experience, skill, muscle power, household endowments, and capital.

Constraints. Any limiting resource: pests, diseases and weeds; access to credit, market infrastructure, and policies.

Mission

The components of the mission are five-fold:

- characterize and evaluate resources
- explore ways of managing production constraints
- develop production systems that are more efficient, stable, and sustainable
- evaluate the adoption of new technology
- develop the principles and practices of resource management in collaboration with NARSs and mentor institutions; and inculcate them through training

Organization and Direction

Before 1986, Economics and Farming Systems were separate programs. Farming Systems was composed of the following units: Agroclimatology, Cropping Systems, Soil Fertility and Chemistry, Soil Physics and Conservation, Land and Water Management, Farm Power and Equipment, and On-farm Research.

Following recommendations from the External Program Review (EPR), the two programs were combined in late 1985 to form a Resource Management Program (RMP) under Dr M. von Oppen. For administrative purposes, three groups were identified: Agronomy, Soil, and Economics. Table 1 lists the units in each group and describes their responsibilities.

Structure

Whereas previous farming systems work was organized around soil types and watersheds where those types were represented, the core of RMP now is crops and crop systems.

Table 1. The groups and units of the Resource Management Program and their responsibilities.

Groups	Units	Responsibilities
Agronomy		
	Agroclimatology	collection and analysis of climatic records, crop modeling, weather and disease
	Cropping Systems	crop physiology/agronomy of inter-cropping/ agroforestry, rice-based systems, contingent crops
	Production Agronomy	testing production systems, on-farm diagnostic surveys
Soil		
	Soil Chemistry	processes determining nutrient availability, legumes as N sources
	Plant Nutrition	nutrient uptake and metabolism, role of mycorrhizae
	Soil Physics	physical properties of agricultural soils, soil water dynamics
	Land and Water Engineering	control of runoff and erosion, supplementary irrigation, implements
Economics		microeconomic surveys and analysis, integrated pest management, adoption, natural resource economics, research resource allocation

Biological input comes from the crop improvement programs and physical input from the environmentally based units. Output to farmers through NARSs is steered and evaluated by Production Agronomy, and Economics.

Allocation of Responsibility

Table 2 shows the distribution of responsibilities among the groups and units of RMP components of the mission statement, and the number of scientists involved. Points to note are the complementarity between the three units in Agronomy, and between Soil Physics and Land and Water Engineering; and the broad program of Economics.

Research Mode

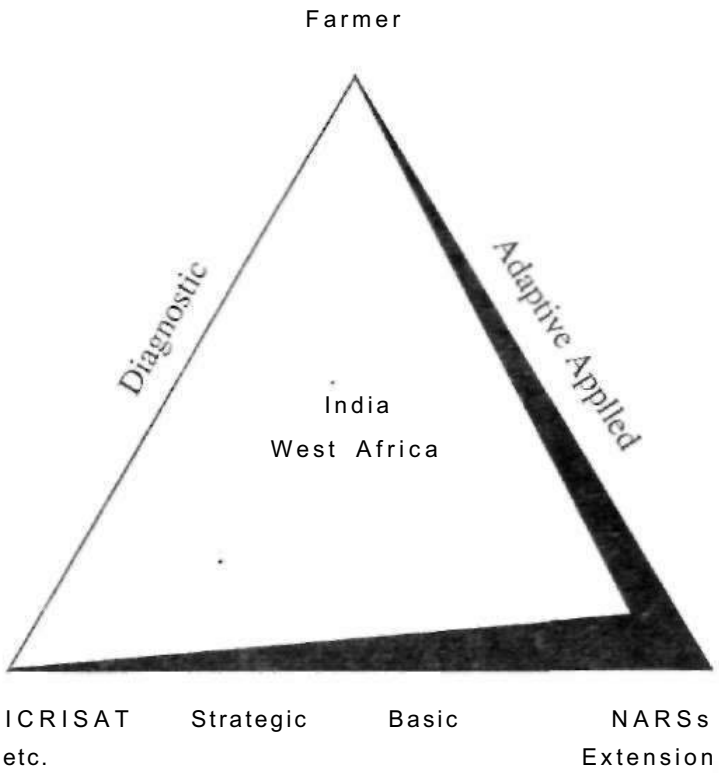
We find it convenient to discuss research modes by arranging the research spectrum around the sides of a triangle which has the farmer at the apex and ICRISAT and NARS scientists

Table 2. The distribution of the components of the mission statement among units the Resource Management Program and the number of scientists involved.

	Mission components					
					Scientists[e]	
Groups and Unit	a	b	c	d	International	National
Agronomy						
- Agroclimatology	*	*			2	1
- Cropping Systems		*	*		1	1
- Production Agronomy			*	*	1	1
Soil						
- Soil Chemistry	*	*	*		1	2 (1)
- Plant Nutrition	*	*			1	1
- Soil Physics	*				1	2
- Land and Water Engineering		*	*		1	3
Economics	*	*	*	*	2(2)	1
Totals	5	7	4	2	10(2)	12 (1)

a. characterize and evaluate resources
b. explore ways of managing constraints
c. develop efficient, stable, and sustainable production systems
d. evaluate and adopt new technology
e. numbers in brackets are externally-funded staff

a. Past



b. Future

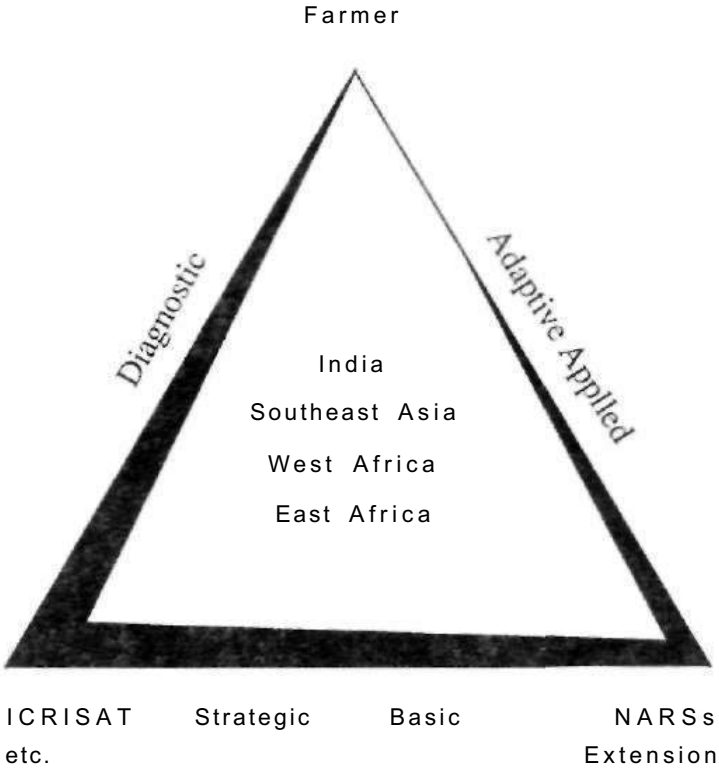


Figure 1. Past (a) and future (b) research modes arranged around the sides of triangles connecting the farmer, and ICRISAT and NARS scientists. The thickness of the sides of each triangle broadly indicates research priorities.

at the ends of the base (Fig.1). Moving around the triangle, there is a progression from strategic and basic research through applied and adaptive to diagnostic research.

The thickness of the sides of the triangle is a broad indication of research priorities. Before the formation of RMP, there was strong emphasis on applied and adaptive research (Fig.la). Over the past four years, more strategic and basic research has been introduced in an endeavor to understand some of the mechanisms governing constraints to production (Fig.lb). We recognize that a swing away from on-farm and diagnostic research has gone too far and should be corrected.

Geographical Distribution

The following list shows the distribution of RMP research activities in different geographical cpuntries and regions.

India	Village-level studies: socioeconomic record from 10 villages in five states over 10 years Watersheds: 2 on Alfisols, 1 on Vertic Inceptisols
West Africa	Village-level studies: socioeconomic record from 10 villages in three agroecological zones for 10 years
Ethiopia	Watersheds: 2 Vertisol sites proposed for ICRISAT contribution to the Joint Vertisol Management Project
Asia	AGLN: participation in surveys, conferences, climatology, soil chemistry, economics

Collaboration

RMP has collaborative activities with several groups and on several issues. These include the following:

International Centers

- International Fertilizer Development Center (IFDC): Nitrogen management
- International Food Policy Research Institute (IFPRI): Income and consumption in West Africa
- International Livestock Center for Africa (ILCA) and International Board for Soil Research and Management (IBSRAM): Vertisol management in Ethiopia
- International Benchmark Sites Network for Agrotechnology Transfer (IBSNAT): Crop modeling

NARSs

- Central Research Institute for Dryland Agriculture (CRIDA): Agroforestry, nutrient management, land/water management
- Institute of Agricultural Research (IAR): Vertisol management in Ethiopia
- All India Coordinated Research Project on Agrometeorology (AICRPA): Agroclimatology
- Directorate of Rice Research (DRR): Rice-based systems

Sustainability

Several of RMP's projects are directly concerned with making production systems more sustainable. We are considering whether further effort is needed. For example, we are asking whether we should attempt to coordinate long-term trials on different production systems within the SAT.

Gender

The Economics Unit takes full account of gender issues when they arise, for example in village-level studies, and has supported a research student working in this area. We are presently considering whether the subject should be allowed to evolve naturally or if more positive action is required.

Conclusion

ICRISAT's Resource Management Program contains a range of disciplines which is unique, and is almost without parallel in other international centers. Elements of the Program have made a major contribution to our understanding of how farming systems operate in the semi-arid tropics and how they can be modified to increase production and income. However, the full potential of this Program has still to be realized. Our rate of progress towards the goal will depend on:

- the rate at which we become involved with production constraints in Asia (through AGLN) and in east and southern Africa
- the rate at which we can achieve an even closer integration of disciplines than we have at present

REGIONAL GROUP REPORTS: COLLABORATION WITH THE AGLN

ADB

D. Nangju and M.S. Rao

Asian Development Bank, Manila

Introduction

We would like to thank ICRISAT for inviting us to discuss opportunities for collaboration between the Asian Development Bank (ADB) and AGLN. This workshop is being held by ICRISAT as an activity of the ADB-financed technical assistance to ICRISAT for strengthening grain legumes research in Asia. This technical assistance for $ 590 000 was approved by the Bank on 10 Jul 1990. This paper will discuss the opportunities for collaboration between AGLN, ADB, and the 11 AGLN countries through the technical assistance grants provided to ICRISAT

ADB Support of Grain Legume Research

It is the Bank's policy to support agricultural research at regional and national levels. At the regional level, the Bank has supported international research centers - including ICRISAT - to ensure that IARCs adequately cover issues of concern to ADB's developing member countries in the Asia-Pacific region, and that research results are transmitted to them. At the national level, the Bank has provided support to research institutes to carry out applied and adaptive research with extension services to disseminate research results to farmers.

The ADB support to international agricultural research is based on a three-point policy: the Bank only supports research of application in the Asian-Pacific region; the Bank does not provide general budget support grants and, the Bank supports specific, measurable, and time-bound research projects pertinent to its operations in the agriculture sector. As of Sep 1990, the ADB has provided $ 22.9 m as grants for 56 activities at 16 international agricultural research centers. About 50% of the support went to the four CGIAR centers, with 87% ($ 9.8 m) of this going to ICRISAT and IRRI, the two centers based in the region.

The ADB's agricultural research policy emphasizes technologies for less favorable environments (i.e. rainfed areas) and for non "Green Revolution" crops. The Bank has promoted technology development and grain legume production expansion under the following projects:

Second crop intensification program loan to Myanmar. Approved in Sep 1983 and completed in March 1990. The production of butter bean, chickpea and other nonlegume crops (wheat, sorghum, and millet) was significantly increased through fertilizers, production and distribution of Rhizobium, construction of storage godowns, and support to four seed farms and two central agricultural research stations.

Secondary crops development project in Nepal. Approved in Sep 1989 and currently being implemented. The production of chickpea, lentil, potato, ginger, maize, millet, and mustard/rapeseed will be increased through strengthening of research and extension, agricultural marketing, and credit.

Technical assistance grants to AVRDC, AVRDC has received $ 4 065 000 as grants for eight projects. The grants financed research and training in vegetable crops including soybean and mung bean, tomato, sweet potato, and Chinese cabbage.

Technical assistance grants to ICRISAT. ICRISAT has received $ 4 445 000 for nine projects. The projects have been mainly aimed at strengthening research on grain legumes. The projects include the collection and evaluation of germplasm (both grain legumes and cereals), chickpea research in Pakistan, pigeonpea research in Sri Lanka, Phase I to support AGLN in four south Asian countries, and Phase II to support AGLN in 11 countries in Asia.

Opportunities for Collaboration

In early 1987, ICRISAT requested ADB support to finance AGLN activities in 11 Asian countries. Due to limited funds and the need for caution it was agreed that the support would be to strengthen grain legume research in four south Asian countries (Bangladesh, Myanmar, Nepal, and Sri Lanka). Phase I was approved in Dec 1987 and completed in Jun 1990.

With the satisfactory completion of Phase I the Bank approved Phase II for strengthening grain legume research in Asia in Jul 1990. The main objective of Phase II is to consolidate the achievements in Phase I countries and to upgrade AGLN activities to seven other Asian countries (People's Republic of China, India, Indonesia, Pakistan, Philippines, Thailand, and Vietnam). The other objectives are to:

- assist Asian NARSs select and test grain legume breeding lines and technologies from ICRISAT, and to help farmers improve their grain legume production
- strengthen research cooperation among ICRISAT and Asian scientists to solve common constraints to grain legume production, and facilitate material and information exchange

- assess and overcome the constraints preventing farmers from adopting technologies and varieties
- train national agricultural research scientists in specific skills related to grain legume research

The technical assistance covers three major components.

Research. Research consists of on-station varietal trials to evaluate new ICRISAT and NARS genotypes, on-farm trials to evaluate varieties and other technologies found promising in on-station trials; adoption studies to identify and overcome constraints to rapid adoption of superior technologies, evaluation of promising grain legume varieties for rainfed rice-based systems, and special collaborative research to solve urgent constraints to legumes production.

Training. Training is tailored to meet the needs of scientists and technicians. The grant will help cover the costs of AGLN members* attendance at short courses conducted at ICRISAT or in-country. Local, ICRISAT, and other regional specialists will be the resource people for these courses.

Coordination and planning. This grant will help support the coordination unit at ICRISAT, review and planning meetings, workshops, visits, and surveys. Review and planning meetings will be held to bring together AGLN countries and ICRISAT to review AGLN collaborative research results in each country, and plan future research and training needs. It will also support the exchange of information through visits of country-AGLN scientists to ICRISAT. Appropriate surveys will also be supported.

The executing agency is ICRISAT which has well established scientific and administrative links with the 11 participating countries. The technical assistance is to be implemented over three years and commenced in Oct 1990.

This technical assistance will help scientists from 11 Asian countries cooperate with ICRISAT and with each other to strengthen their grain legume research. The expected output is adapting high-yielding legume varieties to specific areas, removing constraints to farmers adopting technologies, and increased grain legume research. The Bank has high expectations for the outcome of this project.

In addition, the ongoing ADB-assisted technical assistance for the establishment of a Biotechnology Research and Training Unit and the strengthening of the Genetic Resources Unit of ICRISAT offer opportunities to Asian scientists to collaborate with ICRISAT.

To achieve the objectives outlined, it is imperative that the following issues be resolved during the workshop:

- a detailed research and training plan for each country
- an effective means for channelling ADB grant funds from ICRISAT to the national cooperators
- ensurance that there is no duplication of efforts among donors in support of grain legume research in Asia

Conclusion

We wish the participants success in their deliberations during this workshop* We hope that the Bank's modest support will be a catalyst for promoting grain legume research in the 11 A G L N countries and, that there will be tangible results to benefit the small farmer and the rural poor of Asia.

AVRDC

S. Shanmugasundaram

Asian Vegetable Research and Development Center, Shanhua

Background Information

A V R D C is an international agricultural research center (I A R C) established in 1971 to improve food crop production in developing countries. A V R D C's mandate is " to conduct research, carry out training, and provide basic information on production and marketing of vegetables". The Center is organized into three programs: crop improvement, production systems, and international cooperation. A V R D C is conducting intensive research on Chinese cabbage, mung bean, pepper, soybean, and tomato. A new initiative on onion, garlic, and shallot is planned and the Center is evaluating a number of other vegetables for inclusion in its research program. The Center has about 350 research and technical support staff from 10 countries. The Center's 1989 budget of US $ 9.84 m was provided by the governments of nine countries. Special project funds are provided by a number of international donors.

NARS/AVRDC Joint Achievements

Germplasm exchange. A V R D C scientists, working with N A R S scientists, have assembled almost 34 000 germplasm accessions of all crops. Of these, 5914 are mung bean and 12 662 soybean. In 1983, A V R D C was designated by I B P G R to hold the mung bean base collection. Since 1973 A V R D C has distributed over 250 000 seed packets to 171 countries.

Research achievements. The yield potential of mung bean has increased steadily from 0.3-1 t ha^{-1} to 2.7 t ha^{1}, resistance to Cercospora leaf spot has been incorporated; resistance to bruchids has been identified and is being incorporated, photothermalsensitivity

has been reduced, and some level of powdery mildew resistance and synchronized maturity incorporated into improved lines. These improved lines have pods above the canopy and tolerance to lodging and pod-shattering; AVRDC mung bean lines have been officially released as new cultivars 43 times in 18 countries. They are grown on about 400 000 ha in the People's Republic of China, 488 000 ha in Thailand, and 30 000 ha in Indonesia.

The yield potential of soybean has been increased from 1-2 t ha-[1] to 4,7 t ha[1], germplasm less sensitive to photothermal differences has been identified and used in developing improved soybeans, soybean rust has been studied and vertical and horizontal resistances identified, improved high-yielding vegetable soybeans have been developed, and multiple disease-resistant lines with good seed quality have been tested by NARSs. So far, 17 improved AVRDC varieties have been released by 10 countries. AVRDC-derived soybeans released by NARSs are planted on 360 000 ha in Indonesia, 75 000 ha in Thailand, and about 10 000 ha in Taiwan.

International cooperation. Almost 1000 research and extension staff from 48 countries have been trained at AVRDC and at its regional training program in Bangkok, Thailand.

The AVRDC bilateral programs in Indonesia, Korea, Malaysia, Niger, the Philippines, St. Lucia, Thailand, and Bangladesh interact and exchange technologies. A regional center has been established in Thailand,and others are under negotiation. Networks have been established in southeast Asia (AVNET), in southern Africa (CONVERDS) in collaboration with the Southern African Development Coordination Conference (SADCC) and Southern African Centre for Cooperation in Agricultural Research (SACCAR), and in South Asia (SAVERNET).

A Tropical Vegetable Information Service (TVIS) for Chinese cabbage, mung bean, and soybean has also been established. Two international symposia on mung bean and four symposia on soybean have been organized by AVRDC, and have resulted in global state-of-the-art publications on these crops. A global directory of mung bean and soybean researchers has been prepared and a number of technical bulletins, bibliographies, catalogues, guide sheets, slide sets, and videos have been developed for the NARSs.

AVRDC/NARS/AGLN Collaboration

AVRDC is cooperating with all AGLN NARSs. Further cooperation through collaboration with AGLN is expected to improve the efficiency of AVRDCs activities in Asia. AVRDC also works closely with other IARCs to facilitate research and information exchange. AVRDC expresses its appreciation to AGLN for inviting us to serve as the resource base to fill the gap in research and information needs on mung bean and soybean on at least two occasions. AVRDC's entomologist participated in and contributed to the integrated pest management of mung bean and soybean in Nepal. AVRDC was invited to present lectures and participate in the discussions at the AGLN course organised in Sri Lanka. I had the privilege and opportunity of assisting and working closely with AGLN staff and NARS scientists in that course on behalf of AVRDC. Our participation in the present meeting further demonstrates AVRDC's commitment and keen interest to collaborate with AGLN.

Opportunities for Future Collaboration Between AVRDC and AGLN

NARSs have repeatedly expressed interest in adding mung bean and soybean to the AGLN network, AGLN has recognized the resources available at AVRDC for mung bean and soybean and has used it to bolster AGLN activities. Further consideration needs to be given on how AVRDC expertise may be used since the major constraints to improving mung bean and soybean production for AGLN partners are major targets of research at AVRDC

AVRDC is interested in collaborating with AGLN as an active partner. Any of the following five suggested options could help further extend AVRDC's services to NARSs and strengthen AGLN:

- AGLN could subcontract research on mung bean and soybean by providing funds so that AVRDC could participate actively in the AGLN by providing world germplasm, breeding materials (nurseries), research backup, training, and information.
- AGLN could provide funding to support a senior scientist on mung bean and soybean research at ICRISAT. For this AVRDC could second a scientist to ICRISAT and back-stop the scientist with technologies, materials, and information.
- AVRDC could provide to AGLN research training and information support should AGLN include such components in its proposals to donors. The core research activities of mung bean and soybean will continue to be the responsibility of AVRDC either at its headquarters or at one of its regional centers.
- AVRDC could cooperate with NARSs on mung bean and soybean by having a working group within SAVERNET, or by establishing another network for these two crops.
- AVRDC and ICRISAT could collaborate in a regional coordination mechanism, FLASC, as suggested by a meeting organized by ACIAR and IDRC in Bangkok, 30 Apr - 1 May 1988.

The FLASC proposal is discussed in Appendix 2 of the AGLN Coordinator's Report in these proceedings. AVRDC agrees in principle with such an undertaking with the understanding that the proposed mechanism would focus on priority research areas rather than on meetings and discussions.

FAO/RAS/89/040

D.M. Tantera

FAO/RAS/89/040, Bogor

FAO provides support for strengthening agriculture systems in its member countries. Its main concern is to improve food production for the small farmers in developing countries

of Asia and the Pacific region. To meet this concern, FAO initiated RAS/82/002 in May 1983 entitled the Technical Cooperation among Developing Countries (TCDC) for the Research and Development of Food Legumes and Coarse Grains in the Tropics and Subtropics of Asia. It was funded with $ 860 000 by UNDP and terminated in Jun 1989. Among its achievements are an increased awareness among Asian countries of the need to mobilize resources to improve food legumes and coarse grains, and the provision of a forum for exchange of information, ideas, and materials through newsletters, germplasm exchange, study tours, workshops, and training courses. To achieve these goals RAS/82/002 worked closely with NARSs and IARCS. The project used the TCDC approach and encouraged sharing of experience and information through networking. The Project trained 260 mid-level researchers and distributed 150 improved crop varieties for in-country adaptive tests and evaluation.

Project RAS/82/002: Aims and Objectives

Based on the positive results of Project RAS/82/002, the UNDP has provided $ 2.4 m over three years effective 1 Mar 1990, for a second phase called RAS/89/040 Regional Cooperative Program for Improvement of Food Legumes and Coarse Grains in Asia. The RAS/89/040 project document states that the main aim of this program is to fully utilize the TCDC approach in strengthening national capabilities to provide improved and sustained production, distribution, and utilization of food legumes and coarse grains in Asia. This will in turn lead to the adoption of improved technologies and commitment to appropriate policies and strategies by each member country.

The major function of the RAS/89/040 project is to expand and strengthen a regional cooperative network to share experience, information, expertise, and germplasm among the cooperating countries. When the Project's objectives are fulfilled, the participating countries will have adequately trained manpower, activities in research and technology generation, commitment to extension, postharvest handling and processing of FLCG crops and their products, socioeconomic analysis, and database on FLCG crops in the region. The adoption of some of the technologies by farmers will result in more stable yields of FLCG crops in rainfed and other stressed areas, higher income for the farmers, and new employment opportunities. National food security will be strengthened and improved.

Execution

The project is executed by FAO and implemented by AARD-CRIFC (Agency for Agricultural Research and Development—Central Research Institute for Food Crops) of Indonesia. The fund is channelled to three main activities; $ 1.58 m to provide an effective network for the activities, $ 660 000 subcontracted to ICRISAT for adaptive on-farm trials (AGLOR), and $ 220 000 subcontracted to ESCAP-CGPRT Centre for socioeconomic research at the macroeconomic level.

Future Opportunities for Collaboration

Project activities have been underway for almost 9 months. Among these are the First Regional Coordination Council Meeting held in Beijing, the People's Republic of China in Jun 1990 followed by participation in an International Soybean Processing and Utilization Meeting in Gonzhaling, and a study tour to southern China in Jul 1990. From Aug-Nov, three training courses were conducted in Thailand involving 30 participants; a workshop on unexploited and potential food legumes was held with 40 participants in Thailand; and a workshop on soybean yield gaps was co-sponsored jointly with ESCAP-CGPRT Centre. Two planning/coordination meetings of the ICRISAT component, AGLOR, were attended by the Project Coordinator; one was in the Malang Research Institute for Food Crops (MARIF), in Indonesia and the other at ICRISAT Center, Hyderabad.

RAS/89/040 has shared experience and knowledge among its member countries by publishing the Food Legumes and Coarse Grain Newsletter, a quarterly. Two thousand copies are printed and sent by UN pouch services to member countries for distribution by our National Coordinators.

Indonesia's location in Asia makes it suitable for coordinating networking activities. The country also provides a very variable FLCG crop production environment. The AARD, of the Indonesian Ministry of Agriculture in Indonesia, has supported this activity. The FAO/UNDP program is fully supported by the FAO Country Representative and the UNDP Resident Representative in each member country provides backup to the network.

RAS/89/040 will continue to support NARS programs by providing training and information exchange, shared experiences, and germplasm exchange. The recent workshop on unexploited and potential food legumes has recommended that FAO support R & D of some of these food legume crops because they are not handled by any of the international institutions.

Through its RAS/89/040 project, FAO will be happy to cooperate with ICRISAT/AGLN on the following activities:

- Training junior research and extension personnel in processing, postharvest handling, and utilization of FLCG
- Transferring technology, by building stronger links between research and extension in its member countries
- Organizing workshops and training, and publishing newsletters and bulletins about research/development activities
- Exchanging germplasm of particular interest to participating countries and providing small funds for research on some FLCG crops which are not the responsibility of IARCs
- Sustaining NARSs by providing effective institution building and promoting personnel development
- Encouraging private R & D efforts to improve FLCG crops of the Asian region

Bean/Cowpea CRSP

R.D. Freed

Bean/Cowpea CRSP, East Lansing

Introduction

The Bean/Cowpea CRSP is a partnership between the United States Agency for International Development (USAID), host country institutions, and U.S. institutions. Through joint planning and research implementation the CRSP works to help solve important regional and global problems that relate to increasing the production and utilization of bean and cowpea. The focus of the Bean/Cowpea CRSP is on collaboration between scientists from different countries and different disciplines to solve problems for small-scale farmers.

Focus

CRSP scientists are involved in addressing important constraints caused by limitations due to:

- insects
- diseases
- plant response
- the physical environment
- production-consumption economics, farming systems, and sociocultural factors
- storage, food preparation, nutrition, and health
- education, training, and research capacity

The CRSP has 13 projects in 11 countries. CRSP scientists have made dramatic progress in several areas, including biological nitrogen fixation (BNF), disease and insect resistance, seed storage, integrated pest management (IPM), protein digestibility, food processing, drought, and heat resistance.

Collaboration with AGLN

The opportunities for collaboration between the AGLN and the CRSP include:

- research collaboration in BNF, storage technologies, drought and heat stress, training opportunities including degree and nondegree programs

The CRSP has organized an extensive network of bean and cowpea scientists who are dedicated to research excellence and collaboration. The CRSP scientists are doing cutting-edge basic scientific research on the one hand, and general adaptive research on the other. Some technologies that would have particular relevance to AGLN include:

- seed storage technologies for low resource farmers from Purdue University; simple technologies have been developed to control bruchid infestations
- biological nitrogen fixation from the University of Minnesota
- heat and drought tolerance from the University of California, Riverside
- gemini viruses and biotechnology from the University of Wisconsin
- genetic diversity and biotechnology from the University of California, Davis
- participatory research techniques from Washington State University and Michigan State University
- drought tolerance and MSTAT from Michigan State University

The CRSP brings to the AGLN a group of scientists who are very good at basic research as they relate to international problems. Several CRSP scientists are working very closely with other international centers on various research endeavors. This rich experience makes them an exceptional resource for research and training. The CRSP is looking forward to forging links with the AGLN.

MARDI

M.N. Ramli

Malaysian Agricultural Research and Development Institute, Kuala Lumpur

Introduction

Of the three AGLN legume crops only groundnut is important in Malaysia. Although it is the most widely grown grain legume crop in Malaysia, the area on which it is planted is still small, and declining. In the 1970s, groundnut was planted on between 5000 and 6000 ha (sole crop equivalent); presently this crop area ranges between 1200 and 1700 ha. In 1988, only 2588 t of dry groundnut pod were produced while the total import value for pods and seeds was US $ 14.8 million.

Groundnut is grown during the wet season in Malaysia under rainfed conditions. As a result there is a high incidence of fungal and bacterial diseases in the crop. Bacterial wilt is the most widespread disease on groundnut in Malaysia and is probably the main reason for the crop's decline in recent years. The cheapest and easiest way to control bacterial wilt disease is by growing resistant varieties. Since the groundnut varieties currently grown are susceptible to disease, the development of resistant varieties should help expand groundnut cultivation in Malaysia.

Another way to promote groundnut cultivation in Malaysia is to diversify the groundnut types grown. At present, virtually all the groundnut grown is of the Spanish type for

Mengelembu processed groundnuts. Since the increasing demand for Virginia groundnut - for use in confectionery - is being solely met by imports, there is a potential to grow Virginia groundnut locally. Tropical Virginia groundnut varieties suitable for conditions in Malaysia need to be developed.

Areas of Research

Research needs to be conducted in several ateas to promote groundnut cultivation in Malaysia. These will involve the development of bacterial wilt-resistant Virginia varieties. The following research areas are suggested:

Screening techniques for bacterial wilt resistance. Practical screening techniques are a prerequisite for breeding disease-resistant varieties. Techniques should be effective and efficient in identifying resistant plants among large populations of breeding material. This can be done using a disease nursery or a hot spot.

Introduction and evaluation of groundnut material. Introduction and evaluation of varieties and breeding lines is still the cheapest and easiest way of identifying varieties suitable for the climatic conditions in Malaysia. For this purpose, groundnut varieties and breeding lines of the Spanish, Virginia, and maybe Valencia types from ICRISAT and tropical countries need to be introduced and evaluated for adaptability, yield performance, quality, and disease resistance. Superior varieties and breeding lines identified will be used as parents in breeding programs or released as varieties.

Hybridization program. A major objective of the hybridization program is to develop bacterial wilt-resistant groundnut genotypes. Resistant parents will be crossed with line 7920B-3B, a locally developed line which is endorsed for release. A disease nursery or a hot spot will be developed to screen cultivars for bacterial wilt resistance.

Harvesting. The appropriate time for harvesting Spanish groundnut varieties is known. For processing Mengelembu groundnut the crop can be harvested at between 90 and 100 days after planting. For Virginia groundnut varieties the optimum time to harvest still needs to be determined in order to obtain high yields and good quality confectionery nuts.

Pod filling. Studies pn pod filling are critical for Virginia groundnut as pot studies indicated that gypsum improved pod filling and resulted in higher yield. Unfortunately, these results were not repeated in the field as probably the amount, time of application, and placement were still not optimal. Therefore, more detailed studies will be needed to evaluate rate, time, frequency, and placement of Ca-based inputs.

Supplementary irrigation. Virginia groundnut is less tolerant to drought stress and more responsive to supplementary irrigation than Spanish types. Since groundnut is grown under rainfed conditions in Malaysia and water is a limiting factor during the growing

season, especially during the later growing stage, the response of Virginia groundnut to irrigation and its related agronomic and economic benefits must be studied.

Seed dormancy and viability. Studies indicate poor seed germination of Virginia groundnut, especially with locally produced seed. This might be due to seed dormancy since pods are harvested early for seed production. The viability of Virginia groundnut too needs investigation.

Training

The research capability of groundnut scientists and technicians in Malaysia needs further improvement. We hope this can be done through AGLN. Most of the training could come from visits to ICRISAT and Virginia groundnut-growing countries and through research fellowships.

CGPRT

J.W.T. Bottema

Regional Co-ordination Centre for Research and Development of Coarse Grains, Pulses, Roots and Tuber (CGPRT) Crops in the Humid Tropics of Asia and the Pacific, Bogor

Introduction and Aims

The CGPRT Centre initiates and promotes research, training, and dissemination of information on socioeconomic and related aspects of cultivating coarse grains, pulses, roots and tuber crops in Asia and the Pacific region. In its activities, the Centre aims at serving the needs of institutions concerned with planning, research, extension, and development in relation to CGPRT crop production, marketing, and use. The AGLN crops are included in the Centre's mandate.

Production of these crops lags behind the major cereals (rice and wheat) in Asia. While yields and area under rice and wheat increased significantly from 1975 to 1985 resulting in food self-sufficiency in several countries, the development of other food crops have generally been less positive.

Yet, CGPRT crops remain the main source of livelihood for an estimated 700 million people in the Asia-Pacific region where these crops are grown on about 45% of cultivable

land. CGPRT crops are important in the nonirrigated upland, mostly rainfed areas, and as dry season crops in irrigated areas.

The earlier trends of a stagnant area and yield of CGPRT crops continued up to 1990. Diversification of agriculture in which CGPRT crops should play important roles has increasingly been considered an effective policy to achieve increases in income and employment for the rural populace.

Global surpluses of maize, soybean, and groundnut have led to lower prices in the world market, a difficult test for Asian producers.

Research Objectives

The Centre's research program has five components:

- production system studies
- demand, consumption, and utilization studies
- markets, prices, and trade studies
- commodity studies
- policy and social studies

Activities

Groundnut in Indonesia. Groundnut is the most important grain legume crop after soybean in Southeast Asia. The Centre has attempted unsuccessfully to find assistance from donors to carry out research on groundnut potential in Indonesia, the Philippines, and Thailand.

In 1989, the Centre completed a collaborative activity with the Sub-Directorate General of Food Crops Economics and Postharvest Processing, Ministry of Agriculture of Indonesia. Implicit prices of quality characteristics were determined by paying attention to methods used by traders to determine prices. The major conclusions are:

- The Indonesian groundnut market is well integrated and quality standards meet the needs of food processors near the main production area, Tuban, in East Java
- Groundnut is graded into size classes, and within classes premium prices are paid for color, undamaged grains, and low moisture content
- There are quality differences between imported and domestically produced groundnut; imported groundnut is in the 7-8 mm class, has a high percentage of brown grain, and is largely traded in the country, through interregional channels
- Groundnut promotion programs should emphasize large-seeded varieties in order to compete with imported groundnut
- The market will pay premium prices for drying and cleaning, and domestic groundnut can compete in international markets

Database on CGPRT

In the late 1970s and early 1980s, researchers recognized the increasing importance of secondary crops. They felt that lack of socioeconomic data covering production, marketing, and trade was a major bottleneck in formulating appropriate research and development programs. In 1987, the Centre initiated a pilot activity to compile data on many indicators for major CGPRT crops in Indonesia. In 1989, Thailand and the Philippines were included;

The first regional meeting on the Regional Statistical Database System (RSDS) took place in 1989 and six countries agreed to jointly compile and format statistical data on CGPRT crops. The Centre has contributed software, RSDS-II, which is a user-friendly PC-based database system. The activity is based on open exchange of information among the participating institutions.

RSDS will continue to be supported by the Government of the Netherlands for 1991, By the end of 1990 the databases of Thailand, Indonesia and the Philippines were completed and statistical profiles of CGPRT crops in Indonesia and Thailand were published. Of the grain legumes only groundnut is included in the profiles. Recently Myanmar and Pakistan have indicated their wish to participate, bringing the number of participating countries to eight: Indonesia, Thailand, the Philippines, Sri Lanka, Vietnam, Bangladesh, Pakistan, and Myanmar.

RAS/89/040, Regional Co-operative Programme for Improvement of the Food Legumes and Coarse Grains (FLCG) in Asia

As a follow-up to the earlier regional program for the improvement of FLCG crops (RAS/82/002), RAS/89/040 was formulated as an inter-country TCDC project with 14 participating countries from Southeast, East, and South Asia. In a subcontract arrangement with FAO, the CGPRT Centre will contribute by conducting socioeconomic studies of FLCG crop development and, related activities such as strengthening the FLCG database. Specific activities will be formulated in consultation with participating countries and other related bodies. Areas which are being considered are:

- Socioeconomic studies on the impact of processing and marketing on household economies and rural employment
- Workshops/training courses on the socioeconomic implications of producing, marketing, and processing FLCG crops, on rural employment
- Expanding the database on FLCG crops

The activities will actually start by the end of 1990 and extend over a three-year period.

Opportunities for Collaboration with AGLN

The research activities of ICRISAT and AGLN, and the CGPRT Centre are basically complementary. Past activities demonstrate that there is wide scope for collaboration. Collaboration with AGLN is not limited to formalized research activities but includes

providing information and assistance to visiting AGLN participants and ICRISAT scientists. The Centre welcomes inquiries, and seeks to strengthen its relationship with all regional activities such as AGLN, associated with CGPRT crop development.

ICARDA

W. Erskine and M.C. Saxena

Legumes Program
International Center for Agricultural Research in the Dry Areas, Aleppo

Research Focus

ICARDA started in 1977 with worldwide responsibility for research and training on the improvement of faba bean and lentil, a regional responsibility for the improvement of pasture and forage legumes, and kabuli chickpea, the latter in association with ICRISAT. Up to 1990, research on the improvement of food legumes was done by the Food Legume Improvement Program (FLIP), while research on pasture and forage legumes was done in the Pasture, Forage, and Livestock Program (PFLP). Prompted by the recommendations of the ICARDA External Program Review, research on legumes at ICARDA has recently been reorganized. The research on faba bean is being discontinued at ICARDA headquarters, but genetic resources and documentation activities will continue. We are in a transition period which had lead to the responsibility for faba bean improvement being partly met through collaborative research with NARSs, principally those of Morocco and other Mediterranean countries. Efforts to improve kabuli chickpea and lentil together with forage legumes are now concentrated within the new Legumes Program while research on pasture legumes is being retained within PFLP.

Collaboration with AGLN

The aim of this brief discussion paper is to explore common areas where ICARDA can cooperate with AGLN to assist national programs in Asia to identify groundnut, chickpea, and pigeonpea varieties, and cropping systems best suited for farmer use.

Previous cooperation. Links between AGLN and ICARDA have already been forged through cooperation in the fields of training and traveling workshops/breeders' meets. ICARDA senior staff participated in a short-course group training in grain legumes in Nepal in 1988, and in Bangladesh in 1989. There has been participation from ICARDA in

traveling workshops and breeders' meets in Pakistan in 1986, at ICRISAT in 1987, and in Nepal in 1989. Many AGLN cooperators receive ICARDA / ICRISAT kabuli chickpea and other international nurseries from ICARDA.

Future cooperation. We envisage that cooperation in group training as in-country short courses and participation in traveling workshops / breeders' meets will continue.

It is particularly in the field of lentil improvement that ICARDA is looking to increase collaboration. Half the sown area under lentil in the world is in the countries of South Asia — Bangladesh, India, Nepal, and Pakistan. ICARDA headquarters are situated in West Asia, second main area of lentil production. ICARDA's principal research thrust on lentil was initially targeted to the West Asia and North Africa region with little spin-off being appropriate for other areas. The adaptation of Mediterranean germplasm did not extend to South Asia because of contrasting temperature and daylength environments. More recently, ICARDA has increased its improvement efforts on lentil for South Asia through joint research, particularly in breeding, with the Pakistani and Indian national programs. We aim to further increase the research on lentil in South Asia by initiating a regional lentil research network. A seminar to discuss progress on lentil in the region is to be held in Delhi in March 1991 to define the base-line for the development of such a regional network. We will ensure that the lentil network will work in tandem with AGLN and be complementary to its activities. As the shape of the lentil network becomes clearer, new areas of collaboration with AGLN will emerge.

Collaboration with National Programs

Meanwhile, there is already considerable cooperation between ICARDA and national programs in Asia through international trials, training, documentation (such as LENS newsletter and services), and visits. Although lentil does not come under the aegis of AGLN, national programs in the area usually have a research team working on all the grain legume crops, which means that they work with both ICARDA and AGLN. Our common goal must be to increase the success of these national teams in grain legume improvement without 'over-networking' them.

Peanut CRSP

D.G. Cummins

Peanut CRSP, Georgia and North Carolina State University, Raleigh

Collaboration with AGLN

The most positive area of collaboration between Peanut CRSP and AGLN at the present time is to initiate joint activities on acid soil tolerance in groundnut, provided the Technical Committee and the Board of Directors of the Peanut CRSP approves the project. We need to determine with Dr Roger Hanson of TropSoils CRSP ways to form a three-way interaction. Further, this coordination needs to be with the Peanut CRSP Philippine counterparts since they have been providing the leadership for selecting germplasm and breeding for acid soil tolerance. Peanut CRSP will initiate action to take leadership in coordinating the efforts at the Acid Soil and Shade Tolerance Workshop to be conducted in Los Banos, Philippines in Apr 1990.

I suggest the following:

I will arrange a meeting probably at North Carolina State University (NCSU) with Dr Tom Isleib, Peanut CRSP Breeding Project Leader for Thailand and the Philippines; Dr Johnny Wynne, Peanut CRSP Board of Directors Member from NCSU; Dr Roger Hanson, TropSoils Program Director; and myself as Peanut CRSP Program Director. I will invite Dr Dennis Garrity from IRRI to meet with us for his input and possible coordination with their Cropping Systems program. I will transmit the minutes of this meeting to the AGLN CU and to the full Peanut CRSP Board and its Technical Committee. I will meet with AGLN CU on my next trip to Asia or at some other convenient location.

Plans can include the following:

- Designate participants and an implementation committee for an Acid Soil Tolerance working group
- Determine the role of each collaborating group
- Select sites for testing germplasm, possibly one in the Philippines and another in Indonesia at the TropSoils location, and discuss the possibility of initial screening in solution culture
- Arrange for a chemical and physical characterization of the soils at each site
- Outline a protocol for selection of the lines to be tested each year based on the test area available and the annual cost of the experiments
- Determine the procedure for publishing the annual results of the work
- Determine the annual cost of the program, and whether Peanut CRSP will take up this increased effort from existing budgets or from additional outside funding

RECOMMENDATIONS AND CLOSING SESSION

Dr Nene commended the participants for their efforts in fulfilling the objectives of the workshop. He reemphasized that AGLN is not ICRISAT alone, but consists of scientists from all AGLN countries. The AGLN Coordination Unit at ICRISAT acts only as a catalyst following the wishes of the members.

Recommendations

The following are an amalgamation of the recommendations developed by two groups of scientists, one from South Asian countries and another from Southeast Asian countries (see Recommendations Committee list).

Germplasm

- That AGLN procure all released varieties of AGLN crops from member countries and redistribute them among AGLN countries.
- That germplasm lines of AGLN crops suitable for rice-based cropping systems be supplied to AGLN countries.
- That for groundnut, cold-tolerant and early-maturing lines from China, shade-tolerant lines from the Philippines, and acid soil-tolerant lines from Indonesia be made available to Bangladesh, India, Myanmar, and Nepal.
- That for chickpea and pigeonpea, efforts be intensified to identify and distribute lines with tolerance to saline soils, waterlogging, and Helicoverpa pod borer (in chickpea and pigeonpea), podfly, and Maruca pod borer (in pigeonpea).

Breeding Materials and Trials

- That major problems in AGLN crops be identified for each country, and where common, use material resistant to these problems to cross with adapted local varieties and supply segregating material.
- That ICRISAT continue to supply nurseries and trials on request.

Training

- That the regular training conducted by ICRISAT continue.
- That training programs be increased for technicians and be of 1-2 month duration.
- That training programs should not be confined to ICRISAT Center.
- That the training program include training of trainers.
- That in-country training based on identified priority be included in the training program.
- That in-service fellowships at ICRISAT for participants from AGLN countries be increased.

On-farm Research

- That on-farm research be strengthened within the network.

Information Transfer

- That surveys, monitoring tours, and workshops be organized to understand production constraints and identify methods to overcome them.
- That teams for survey and monitoring tours be multidisciplinary and include scientists from NARSs and ICRISAT

Information Exchange

- That publications on AGLN crops be supplied to all research institutions libraries, and AGLN members.
- That AGLN play a key role in the exchange of germplasm, and that AGLN members develop germplasm catalogues of AGLN crops available in their country.
- That AGLN prepare a compendium of crop production technologies being followed in AGLN countries.
- That ICRISAT prepare primers on AGLN crops for farmers.
- That a half-yearly literature update on each legume crop be sent to AGLN countries on request.

Funds

- That in each country, the country-AGLN Coordinators be given the flexibility to reallocate funds according to their country's priorities but only to activities agreed upon.

General

- That efforts continue to establish a larger network that includes soybean, mung bean, urdbean, and lentil as well as the AGLN crops, which can interact with AGLN,

Closing

Dr Faris thanked country coordinators for their dedication in giving the network direction and for the progress made since the inception of AGLN. Organizations and countries outside the network were also thanked for contributing to the workshop.

The change in the network's direction was shown in the present workshop where the country-AGLN Coordinators, rather than the AGLN CU had the major input of ideas. Country-AGLN Coordinators will continue to be given greater responsibility in the running of the network.

He thanked Dr Swindale, Dr Nene and all ICRISAT scientists for their support to the network and wished all the visitors a safe journey home.

Back row (left to right): C. Johansen, M.P. Pimbert, D.V.R. Reddy, R. Matsunaga, S.N. Nigam, M. Matiur Rahman, J.A. Wightman, J.P. Moss, K.B. Saxena, T.G. Kelley, M.H. Mengesha, N.M. Horn, Jagdish Kumar, Onkar Singh, O. Ito, R.P. Ariyanayagam

Middle row (left to right): M.N. Ramli, M.P. Haware, O.P. Rupela, S.M. Virmani, M.V. Reddy, C. Yadav, P. Supharngkasen, D.H. Smith, S.S. Lateef, L.J. Reddy, C.M. Pattanayak, V.K. Mehan, C.S. Pawar, S. Shanmuga-sundaram, S.N. Silim, P.I. Ferguson, S.L. Dwivedi, B. Diwakar, S.C. Sethi

Front row (left to right): M.A. Khaleque, Tran Dinh Long, D.S. Pathic, S.J.B.A. Jayasekera, D.G. Faris, E.A. Kueneman, Hu Jiapeng, S.P. Ambrose, C.R. Escaño, L.D. Swindale, S. Lal, P.V. Shenoi, Pham Van Bien, D. McDonald, Kyaw Moe, D.M. Tantera, R.D. Freed, P.S. Reddy

Participants

Coordinators

Bangladesh
M.A. Khaleque
Project Director (Oilseeds)
Bangladesh Agricultural Research Institute
Joydebpur, Gazipur 1700

M. Matiur Rahman
Principal Scientific Officer (Pulses)
Pulses Improvement Program, BARI
Regional Agricultural Research Station
Ishurdi, Pabna

People's Republic of China
Hu Jiapeng
Associate Professor
Institute of Crop Germplasm Resources
Chinese Academy of Agricultural Sciences
30, Bai Shi Qiao Road
Beijing

India
S.Lal
Director
Directorate of Pulses Research (ICAR)
Kalyanpur
Kanpur 208 024
Uttar Pradesh

P.S. Reddy
Director
National Research Centre for Groundnut (ICAR)
Thimbawadi
Junagadh 362 015
Gujarat

Myanmar
U Kyaw Moe
Deputy Assistant General Manager
Food Legume Division
Agricultural Research Institute
Yezin,
Pyinmana

Nepal
D.S. Pathic
Coordinator (Oilseeds)
National Oilseed Research Program
Nawalpur, Sarlahi
Janakpur Zone

Chitranjan Yadav
Coordinator (Pulses)
National Grain Legumes Research Program
Rampur, Chitwan
Naraini Zone

Philippines
C.R. Escano
Director
Crops Research Department
PCARRD
Los Banos
Laguna

Sri Lanka
S.J.B.A. Jayasekera
Agricultural Research Station
Pallekele
Kundasale

Thailand
Phaisal Supharngkasen
Director
Khon Kaen Field Crops Research Centre
Department of Agriculture
Khon Kaen 40000

Vietnam
Pham Van Bien
Deputy Director
Institute of Agricultural Sciences for South Vietnam (IAS)
121 Nguyen Binh Khiem
Ho Chi Minh City

Tran Dinh Long
Grain Legume Breeder
National Institute of Agricultural Science (INSA)
102, D7 Fuongmai, Dong Da
Hanoi

Senior Officer-Field Food Crop Group
FAO/AGPC, FAO of UN
Via delle Terme di Caracalla
00100 Rome
Italy

FAO RAS/89/040
D.M. Tantera
Regional Coordinator
FAO RAS/89/040
Jalan Merdeka 145
Bogor 16111
Indonesia

Observers

Malaysia
M.N, Ramli
Deputy Director of Horticulture
MARDI
P.O. Box 12301, G.P.O.
50774 Kuala Lumpur

AVRDC
S. Shanmugasundaram
Director, International Cooperation
AVRDC
P.O. Box 42, Shanhua, Tainan
Taiwan 74103
Republic of China

Bean/Cowpea CRSP
R.D. Freed
Deputy Director
Bean/Cowpea CRSP
200 International Center,
Michigan State University
East Lansing, MI 48824
United States of America

FAO
E.A. Kueneman

ICRISAT

Administration
L..D. Swindale
Director General

Y.L. Nene
Deputy Director General

S.P. Ambrose
Assistant Director General (Administration)

P.V. Shenoi
Assistant Director General (Liaison)

B.C.G. Gunasekera
Advisor to DG on Donor Relations

LegumesProgram

R.P. Ariyanayagam
Principal Pigeonpea Breeder

S.L. Dwivedi
Groundnut Breeder II

D.G. Faris
Principal Coordinator, AGLN

M.P, Haware
Plant Pathologist II

N.M. Horn
Assistant Virologist

O. Ito
Principal Agronomist

C. Johansen
Principal Agronomist

Jagdish Kumar
Senior Chickpea Breeder

S.S. Lateef
Senior Entomologist

R. Matsunaga
Associate Physiologist

D. McDonald
Program Director

V.K. Mehan
Plant Pathologist II

J.P. Moss
Principal Cell Biologist

S.N. Nigam
Principal Groundnut Breeder

C.S. Pawar
Entomologist

M.R Pimbert
Principal Entomologist

D.V.R. Reddy
Principal Virologist

L. J. Reddy
Senior Groundnut Breeder

M.V. Reddy
Senior Plant Pathologist

O.P. Rupela
Crop Physiologist II

K.B.Saxena
Senior Pigeonpea Breeder

S.C Sethi
Chickpea Breeder lI

S.N. Silim
International Associate Scientist

Onkar Singh
Chickpea Breeder II

D,H. Smith
Principal Pathologist

L A. Wightman
Principal Entomologist

Resource Management Program

M.M. Anders
Principal Production Agronomist

T.G. Kelley
Assistant Principal Economist

J.L. Monteith
Program Director

C.K. Ong
Principal Agronomist, Cropping Systems

S.M. Virmani
Principal Agroclimatologist

Genetic Resources Unit

M.H. Mengesha
Principal Germplasm Botanist
and Program Leader

Human Resources Development Program

B. Diwakar
Senior Training Officer

Crop Quality Unit

R. Jambunathan
Principal Biochemist and Program Leader

Cooperative Cereals Research Network

C M . Pattanayak
Principal Coordinator

Farm Development and Operations

D.S. Bisht
Manager

Information Services

J.B. Wills
Head

P.I. Ferguson
Visiting Editor

Acronyms

AARD	Agency for Agricultural Research and Development (Indonesia)
ACIAR	Australian Centre for International Agricultural Research
ADB	Asian Development Bank (Philippines)
AGLN	Asian Grain Legumes Network (ICRISAT)
AGLO	Asian Grain Legumes On-farm (Research Project) (Precursor of AGLOR)
AGLOR	Asian Grain Legumes On-farm Research (ICRISAT)
AICORPO	All India Coordinated Research Projects on Oilseeds
AICPIP	All India Coordinated Pulses Improvement Project
AICRPA	All India Coordinated Research Project on Agroclimatology
APAARI	Asia-Pacific Association of Agricultural Research Institutions
APAU	Andhra Pradesh Agricultural University
ARFSN	Asian Rice Farming Systems Network (IRRI)
AVNET	Collaborative Vegetable Research Network in Southeast Asia (AVRDC)
AVRDC	Asian Vegetable Research and Development Center (Taiwan)
BARI	Bangladesh Agricultural Research Institute
BGM	Botrytis gray mold
BNF	Biological nitrogen fixation
CAAS	Chinese Academy of Agricultural Sciences
CAB	Commonwealth Agricultural Bureaux (UK)
CGIAR	Consultative Group on International Agricultural Research
CGPRT	Regional Co-ordination Centre for Research and Development of Coarse Grains, Pulses, Roots and Tuber Crops in the Humid Tropics of Asia and the Pacific (Indonesia)
CIAT	Centro Internacional de Agricultura Tropical (Colombia)
CIDA	Canadian International Development Agency
CIYT	Chickpea International Yield Trial (ICARDA)
CONVERDS	Collaborative Network for Vegetable Research and Development in Southern Africa
CQU	Crop Quality Unit (ICRISAT)
CRIDA	Central Research Institute for Dryland Agriculture (India)
CRIFC	Central Research Institute for Food Crops (Indonesia)
CRSP	Collaborative Research Support Program (USAID)
CU	Coordination Unit
CVT	Coordinated Variety Trial (Nepal)
DFAMS	Department of Food and Agriculture Marketing Service (Nepal)
DOA	Department of Agriculture
DPR	Directorate of Pulses Research (India)
DRR	Directorate of Rice Research (India)
DT	Determinate type (pigeonpea)
ELISA	Enzyme-Linked Immunosorbent Assay
EPR	External Program Review (at ICRISAT)

EPIT	Early Pigeonpea International Trial
ESGAP	Economic and Social Commission for Asia and the Pacific (Indonesia)
ESD	Extra-short-duration
EXPIT	Extra Early Pigeonpea International Trial
FAO	Food and Agriculture Organization, United Nations (Italy)
FFT	Farmers' Field Trial (Nepal)
FLASC	Food Legumes Asia Steering Committee
FLCG	Food Legumes and Coarse Grain
FLCGN	Food Legume and Coarse Grain Newsletter (FAO)
FLIP	Food Legume Improvement Program (ICARDA)
GIS	Geographic information system
GRU	Genetic Resources Unit (ICRISAT)
HRD	Human resource development
IAR	Institute of Agricultural Research (Ethiopia)
IARC	lnternational agricultural research center
IAS	Institute of Agricultural Science (Vietnam)
IBPGR/IPGRI	International Board for Plant Genetic Resources (Italy)
IBSNAT	International Benchmark Sites Network for Agrotechnology Transfer (USA)
IBSRAM	International Board for Soil Research and Management (Thailand)
ICAR	Indian Council for Agricultural Research
ICARDA	International Center for Agricultural Research in the Dry Areas (Syria)
ICCV	ICRISAT Chickpea Variety
ICGS	ICRISAT groundnut selection
ICGV	ICRISAT groundnut variety
ICPL	ICRISAT pigeonpea line
ICRISAT	International Crops Research Institute for the Semi-Arid Tropics (India)
IDRC	International Development Research Centre (Canada)
IEGVT	International Early Maturing Groundnut Variety Trial (ICRISAT)
IFDC	International Fertilizer Development Center (USA)
IFPRI	International Food Policy Research Institute (USA)
lITA	International Institute of Tropical Agriculture (Nigeria)
ILCA	International Livestock Center for Africa (Ethiopia)
INSA	National Institute of Agricultural Science (Vietnam)
IPM	lntegrated pest management
IPMDN	International Pigeonpea Multiple Disease Nursery (ICRISAT)
IPPRN	International Pigeonpea Pests Resistance Nursery (ICRISAT)
IRRI	International Rice Research Institute (Philippines)
KKU	Khon Kaen University (Thailand)
KU	Kasetsart University (Thailand)
LD	Long duration
LEGOFTEN	Legume On-Farm Testing and Nurseries (ICRISAT)
MAFI	Ministry of Agriculture and Food Industry (Vietnam)
MARDI	Malaysian Agricultural Research and Development Institute
MARIF	Malang Research Institute for Food Crops (Indonesia)
MAS	Myanma Agriculture Service

MD	Medium duration
MMSU	Mariano Marcos State University (Philippines)
MOU	Memorandum of understanding
MPIT	Medium Pigeonpea International Trial (ICRISAT)
MSTAT	A microcomputer program for the management and analysis of agronomic experiments (Michigan State University)
NARC	National Agricultural Research Center (Nepal)
NARRDN	Natural Resources Research and Development Network (Philippines)
NARS	National agricultural research system
NAS	Nepalgunj Agricultural Station (Nepal)
NBPGR	National Bureau of Plant Genetic Resources (India)
ITP	Indeterminate type (pigeonpea)
NGLRP	National Grain Legumes Research Program (Nepal)
NORP	National Oilseed Research Program (Nepal)
NRCG	National Research Centre for Groundnut (India)
PeanutCRSP	Peanut Collaborative Research Support Program (USAID)
PCARRD	Philippine Council for Agriculture, Forestry and Natural Resources Research and Development
PFLP	Pasture, Forage, and Livestock Program (ICARDA)
PMV	Peanut mosaic virus
PStV	Peanut stripe virus
R & D	Research and development
RAS/82/002	TCDC for the research and development of food legumes and coarse grains in the tropics and subtropics of Asia (FAO/UNDP project)
RAS/89/040	TCDC for regional cooperative program for improvement of food legumes and coarse grains in Asia (FAO/UNDP project)
RCCM	Regional Coordination Council Meeting (RAS/89/040)
RMP	Resource Management Program (ICRISAT)
RSDS	Regional Statistical Database System (CGPRT Centre)
SACCAR	Southern Africa Centre for Cooperation in Agricultural Research (SADCC)
SADCC	Southern African Development Coordination Conference (Botswana)
SAT	Semi-arid tropics
SATCRIS	Semi-Arid Tropical Crops Information Service (ICRISAT)
SAVERNET	South Asian Vegetable Research Networks (AVRDC)
SD	Short duration
SM	Sterility mosaic (disease of pigeonpea)
TCDC	Technical Cooperation among Developing Countries (FAO)
TVIS	Tropical Vegetable Information Service
UK	United Kingdom
UNDP	United Nations Development Programme
UPLB	University of Philippines Los Banos
USAID	United States Agency for International Development

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International Crops Research Institute for the Semi-Arid Tropics
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