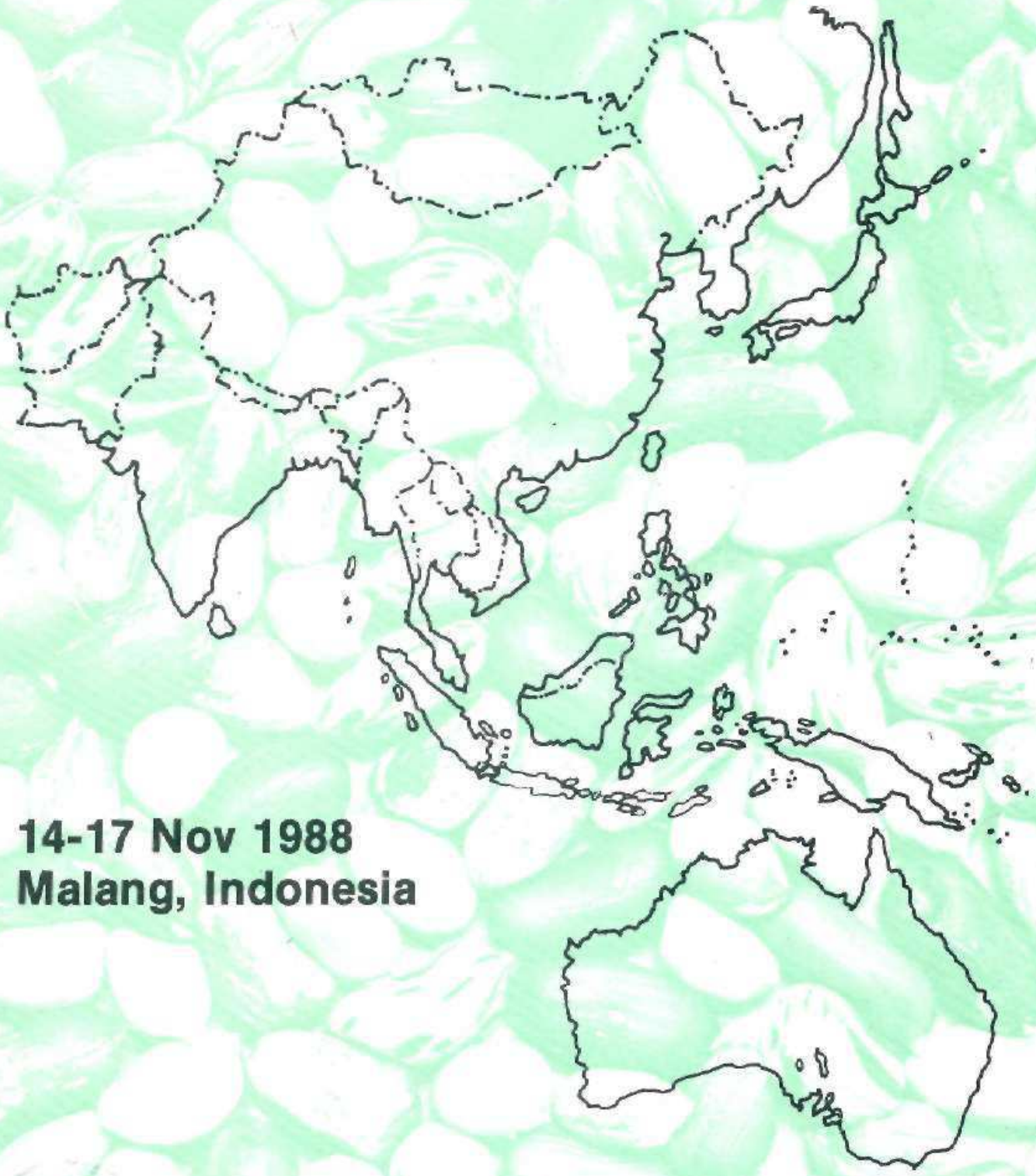
Summary and Recommendations of the Asian Region Groundnut Scientists' Meeting



14-17 Nov 1988
Malang, Indonesia

International Crops Research Institute for the Semi-Arid Tropics

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Co-sponsors

	Agency for Agricultural Research and Development (AARD) Ministry of Agriculture Indonesia
	International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) India

ICRISAT

International Crops Research Institute for the Semi-Arid Tropics
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Abstract

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Fifty-two scientists from national, regional, and international research institutions concerned with groundnut production in the Asia region met at the Malang Research Institute for Food Crops (MARIF), Malang, Indonesia, from 14 to 17 Nov 1988. The meeting was organized by ICRISAT in cooperation with the Indonesian Agency for Agricultural Research and Development (AARD). Problems of groundnut production in the region and ways to overcome constraints to production through collaborative projects were discussed.

International research organizations' inputs were reviewed, and topics covered concerned diseases, pests, photoperiod and temperature, drought, nutrient stresses, postharvest technology and aflatoxin, germplasm collection and adaptation, crop production, international cooperation and training, and groundnut research in Indonesia.

Priorities for research were agreed, and recommendations were made for continued research collaboration and increased training for scientists within the region.

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Resume

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Cinquante-deux chercheurs provenant des instituts de recherche nationaux, regionaux et internationaux se sont reunis a l'Institut de recherche sur les cultures vivrieres de Malang (MARIF), a Malang, en Indonesie, du 14 au 17 novembre 1988. La reunion, organisee conjointement par l'ICRISAT et l'Agence indonesienne pour la recherche et le developpement agricole (AARD), a ete consacree aux problemes de la production arachidiere dans la region asiatique ainsi qu'aux mesures a prendre pour surmonter ces contraintes grace aux projets cooperatifs.

Le bilan sur les contributions des instituts internationaux de recherche a ete dresse et les discussions ont porte sur les themes divers tels que : maladies et ravageurs, photoperiodisme et temperature, secheresse et carences en elements nutritifs, technologie post-recolte et aflatoxines, collection des ressources genetiques et adaptation, systemes de production, cooperation internationale, formation et recherche arachidiere en Indonesie.

Des priorites de recherche ont ete etablies suivies des recommendations faites pour la poursuite des recherches cooperatives et pour Intensification de la formation des chercheurs de la region.

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Proceedings Editor

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Opening Session

Dr Soetatwo Hadiwigeno, Director General, Agency for Agricultural Research and Development (AARD), Ministry of Agriculture, Indonesia, welcomed participants to the Asian Region Groundnut Scientists' Meeting and introduced Ir Effendi Salam, Deputy Minister for Agriculture, East Java. He stressed the importance of groundnut to both producers and consumers in the region and the need to increase production and quality. Dr. Soetatwo expressed his pleasure that AARD could co-sponsor the meeting and trusted that it would enable scientists from national and international organizations to exchange information and ideas, to recommend research priorities at national and regional levels, and to plan cooperation at all levels.

Dr Ibrahim Manwan, Director, Central Research Institute for Food Crops (CRIFC), Bogor, then addressed the participants. He stressed the need for effective coordination of all international and regional research and donor organizations with one another and with national agricultural research programs to understand groundnut production problems and to pursue appropriate research strategies.

Dr Sutaryo Brontonegoro, Director, Malang Research Institute for Food Crops (MARIF), Malang, added his welcome to participants.

Objectives of the Meeting

Y.L. Nene, Program Director (Legumes), ICRISAT presented the objectives of the meeting. Scientists from national, regional, and international research institutions concerned with groundnut production in the Asia region were brought together in order to:

- discuss problems affecting groundnut production in the various parts of the region and exchange research information,
- identify the most important problems, and indicate their extent and where they are most serious,
- recommend priorities for research at national and international levels, and suggest collaborative research activities,
- discuss training needs in relation to agreed priority research areas, and
- facilitate interactions among groundnut scientists in the region, and encourage cooperation at all levels.

Groundnut Research Cooperation through SAARC

P.S. Reddy

The South Asian Association for Regional Cooperation (SAARC) project on groundnut comprises seven countries conducting research on common constraints to groundnut production through regional multilocational variety trials.

IDRC's Support for Groundnut Research

Aran Patanothai

The International Development Research Centre (IDRC) acts mainly as a funding agency for research and training projects in the region. It supports three types of projects aimed at increasing grain legume production and utilization—breeding and improvement projects, cropping systems projects within the Asian Rice Farming Systems Network, and projects aimed at better preservation and utilization of grain legumes. IDRC projects are typically small, with a specific focus, and often lead to the establishment of networks among similarly focused projects.

Winrock Internationals Research on Groundnut in Indonesia

D. Sharma

In the projects it supports, Winrock International emphasizes the development of individual potential. In keeping with this emphasis, its project in Indonesia, funded by USA1D, is closely integrated with the ongoing research of MARIF groundnut scientists.

The ATA Project in Indonesia

F. Geurts

The Agriculture Technical Assistance project (ATA-272) in Indonesia, funded by the Government of the Netherlands, provides assistance in the form of technical expertise, equipment, and training and is focused principally on grain legumes. This work is also closely coordinated with the MARIF projects.

Chairman's Remarks

Aran Patanothai

Several significant points emerged during discussions on the various international and regional organizations:

- In spite of the presence of several organizations and collaborative projects operating at different levels in the region, national programs continue to face shortages of funds and trained manpower.
- The assistance to national programs by the various organizations has greatly benefited the national programs, and has been well received and appreciated. However, because of the large number of assisting agencies involved and their commonly involving the same national program scientists, assistance programs can become a burden to national programs. Better coordination is needed both among assisting agencies and among different agencies within the national programs.
- This meeting is expected to help ICRISAT to determine future direction of work for the region. National programs should use this meeting to their maximum benefit by indicating their needs. As international institutes are established to help the national programs, the more benefits national programs can take from international institutes, the better the international institutes can accomplish their goals.

Discussion Summaries

Diseases

Chairman: K.J. Middleton, Co-Chairman: Sopone Wongkaew

It was agreed that diseases are important constraints on groundnut production throughout the region. The collaborative work by AARD, ACIAR, and ICRISAT on screening 9000 germplasm lines for PStV resistance in Indonesia was commended. However, more country and regional surveys are needed to obtain a clearer picture of the distribution of other diseases; and crop loss assessments are needed to determine their economic significance. A better understanding of requirements in this area should emerge from the Workshop on Agroclimatology of Asian Grain Legume Growing Areas to be held at ICRISAT Center 5-17 Dec 1988. The present meeting indicated that priority should be given to research on foliar fungal diseases (rust, *Puccinia arachidis;* late leaf spot, *Phaeoisariopsis personata;* early leaf spot, *Cercospora arachidicola);* virus diseases, especially PStV disease and bud necrosis disease (BND), caused by tomato spotted wilt virus (TSWV); bacterial wilt; and theaflatoxin contamination problem resulting from infection by toxigenic strains of *Aspergillus flavus.* A plea was made for more interest to be taken in seed and seedling diseases.

Recommendations

- The influence of cropping systems and seasonal variations in weather on diseases should receive more attention, particularly in respect to foliar fungal diseases and bacterial wilt.
- More use should be made of the sources of resistance to rust and late leaf spot currently available from ICRISAT.
- The economic importance of PStV should be established by surveys and crop loss assessments within the region.
- The isolates of PStV from various parts of the region should be compared and studied in a country where groundnuts are not grown.
- Screening of groundnut and interspecific hybrid derivatives for resistance to PStV should continue as an international cooperative project, and resistance breeding should be done by the involved international agencies.
- The distribution and economic importance of BND should be established for the region.
- Information on control of BND by modification of cultural practices should be made available, as well as information on other virus diseases.
- Information on the occurrence of bacterial wilt, its spread, and on diagnosis of the disease should be made available through existing newsletters. ACIAR Bacterial Wilt and ICRISAT International Arachis Newsletters should exchange relevant articles.

- An international cooperative project along the lines of the Peanut Stripe Virus Project should also be initiated by ACIAR for bacterial wilt in order to coordinate research, exchange resistant germplasm, and investigate *P. solanacearum* isolates from different parts of the world.
- National institutions should examine their groundnut produce and products to determine the importance of aflatoxin contamination in their countries.
- Both preharvest and postharvest infection of groundnuts by the toxigenic *A. flavus* should be examined in order to give appropriate crop management recommendations to growers.
- Resistance to preharvest seed infection by *A. flavus* exists and should be utilized to reduce the aflatoxin contamination both before and after harvest.
- Soil/seed and seedling disease interactions should receive further attention. The benefits of seed protectants should be evaluated.
- The importance of diseases caused by *Sclerotium rolfsii* may be exaggerated and should be investigated. Cultural control measures should be developed rather than giving undue emphasis to resistance breeding.
- Training should be provided on survey and crop loss assessment methods, on diagnosis of diseases, on resistance screening techniques, and on disease management practices.

Pests

Chairman: W.C. Campbell, Co-Chairman: J.A. Wightman

While it was accepted that a wide range of pests occur on groundnut, it was not believed that their presence seriously affects groundnut production in all countries. The need for pest surveys and for evaluation of losses caused by pests was strongly emphasized. Sources of resistance to many of the more commonly encountered insect pests of groundnut are available from the USA and from ICRISAT. Host plant resistance should be a major component of integrated pest management (IPM) systems. Major pests are thrips (Thysanoptera) and aphids (Aphidae) (feeding damage and as virus vectors), leaf miners *{Aproaerema modicella),* hairy caterpillars (Lepidoptera), Spodoptera, *Helicoverpa,* ants, white grubs (Scarabaeidae), termites (Isoptera), spider mites (Acari), and millipedes. Rats and wild pigs are serious pests in Indonesia and Pakistan. Termites and some other soil pests can be important in predisposing pods/seeds to invasion by *A. flavus.* Nematodes are also capable of causing serious diseases, but very little is known of their distribution and economic importance.

Recommendations

- Pest surveys and crop loss assessments should be undertaken to establish the economic significance of groundnut pests.

- Pest control research should be coordinated across crops to establish effective systems.
- More use should be made of the sources of resistance to pests currently available in the USA, at ICRISAT, and in national programs. Host plant resistance is an important component of IPM schemes.
- The possibility of forecasting virus epidemics by detection of virus particles in trapped insect vectors should be investigated.
- The relationship between thrips populations and yellow spot virus in Thailand should be studied.
- More attention should be given to the use of insect pathogens for biological control of pests.
- Training should be provided on pest survey and crop loss assessment methods, on identification of insect pests, particularly thrips, and on IPM systems.

Photoperiod and Temperature

Chairman: R.C.N. Rao, Co-Chairman: G. Wright

Research on the effect of photoperiod on groundnut is being pursued by ACIAR and ICRISAT. At ICRISAT Center genotypes varied in their sensitivity to extended photoperiod, and experiments using the phytotron at the Commonwealth Scientific and Industrial Research Organization (CSIRO), Canberra, Australia, gave supporting evidence. However, field experiments at Kingaroy, Queensland, did not show any photoperiod responses in genotypes identified as photoperiod sensitive at ICRISAT or in the phytotron. The possibility that high intensity and duration of irradiances at Kingaroy could be interacting with, and confounding photoperiod effects will be examined. In limited studies at ICRISAT Center interactions between photoperiod and diseases (rust and late leaf spot) were indicated.

Low temperature was identified as a problem for summer groundnut production in India and in the north of the People's Republic of China, where plastic film is used to enhance soil temperatures and conserve moisture.

It was strongly felt that photoperiod could be an important factor in adaptation breeding and in the international exchange of germplasm.

Recommendations

- Research on the mechanisms of photoperiod effects and their interaction with other environmental factors should be continued. This research was considered to be a more appropriate field for ICRISAT and ACIAR than for national programs.
- ICRISAT and ACIAR should cooperate to further investigate the effects of photoperiod and irradiance on yield of groundnuts and so enhance the understanding of cultivar adaptation in environments with different photoperiods.
- National programs within India should be encouraged to address the low temperature problem.

Drought

Chairman: G. Wright, Co-Chairman: R.C.N. Rao

Two major drought patterns affecting groundnut yields in the region were identified. Intermittent drought is typified by upland rainfed cropping systems where protracted drought stress of unpredictable timing and severity is common; and terminal drought is typified by lowland post-rice cropping systems where groundnuts are sown on a full soil moisture profile and are dependent solely upon stored soil water for crop growth. A third condition also needs to considered in humid tropical regions where waterlogging occurs very early or very late in the season in dry-season crops.

Drought-tolerant germplasm lines are being identified at ICRISAT Center based on their yield performance under a range of intermittent and terminal drought regimes. Comparative physiological studies of the drought-tolerant genotypes are being undertaken by ICRISAT and ACIAR to better understand the processes involved and to improve the selection criteria for drought tolerance to be used in breeding programs. While no specific physiological traits can yet be recommended, potential selection for drought tolerance has been identified in the areas of (1) superior rooting characteristics and soil water extraction capability, (2) water-use efficiency, and (3) partitioning of assimilate into pod growth.

Recommendations

- The carbon isotope discrimination technique developed by the Australian National University, Canberra, gives a close correlation with groundnut water-use efficiency, and further development should be encouraged as it has excellent potential for use in selection of drought-tolerant genotypes.
- International organizations should cooperate in investigating the physiological processes involved in improved drought tolerance in order to provide information to national programs on suitable drought-tolerance traits for selection purposes.
- A number of drought-tolerant genotypes are available from ICRISAT Center; it is vital that data on their performance under a range of drought conditions throughout the region be relayed back to ICRISAT.
- As the ICRISAT genotypes derive their drought tolerance from superior rooting and water extraction capabilities, and as these abilities may be adversely influenced by acid soil conditions, it is suggested that in regions where both drought and acid soil problems occur, the priority for research by national programs should be in the area of acid soil tolerance.
- National programs should examine management options aimed at escaping the effects of drought, e.g., intercropping groundnut genotypes of different maturities and varying plant populations. Results of such work should be given priority for publication in appropriate national and international newsletters.

Nutrient Stresses

Chairman: J.R. Burford, Co-Chairman: M. Machmud

The discussion on nutrient stresses resulted in a brief compilation of nutrient requirements and known nutrient disorders, based on contributions from country representatives. The use of nitrogen (N) and phosphorus (P) fertilizers is recommended in almost all countries. Requirements for potassium (K) and sulfur (S) have been established, particularly for sandy soils, in about half of the countries represented, but only two have recognized micronutrient deficiency disorders or the more complex problems arising from growing groundnuts in acid or alkaline soils. It became apparent that information on nutritional problems in groundnut in the region was sketchy and poorly reported. Two useful general comments were that (1) groundnut is generally robust, e.g., in its ability to extract P from soil, and (2) most cultivars are tolerant of a wide range of soil pH from moderately acid to moderately alkaline. The extent of soils with extreme acidity or alkalinity appears to be less than previously thought Alkalinity seems to be most important in India, and acidity in the Philippines and some of the transmigration areas of Indonesia.

Recommendations

- A detailed inventory of nutrient disorders in groundnut across the Asia region should be compiled.
- Adequate diagnostic or predictive tests for determining the occurrence and severity of individual nutrient disorders should be developed. Criteria for P fertilizer inputs are particularly important.
- Priority should be given to research on extremely acid soils (pH < 5) to determine interactions with nutrient disorders. The AARD/ACIAR project, which has links with the Philippines through Peanut CRSP, should be supported.
- Screening of germplasm for tolerance of acid soils in the Philippines should be encouraged and supported.
- ICRISAT should provide a catalog of cultivars sensitive to alkalinity-induced iron chlorosis.
- Nitrogen fixation by groundnuts should be quantified.
- Research on soil processes should be expanded to better understand the problems involved in acid soils, waterlogging, nodulation, seedling establishment, and diseases, and to determine diagnostic criteria in soil.

Postharvest Technology and Aflatoxin

Chairman: M. Machmud, Co-Chairman: J.R. Burford

Drying and storage of groundnut products are important aspects of postharvest technology that may be adversely affected by rainfall during field drying, poor or inappropriate drying procedures, poor storage facilities, etc. These factors increase the likelihood of seeds being invaded by the aflatoxigenic *A. flavus,* with resulting contamination of the produce with aflatoxins. Other factors influencing fungal invasion and aflatoxin production are cropping systems, late-season drought stress, and damage to pods and seeds by pests (millipedes and termites preharvest, and storage insects postharvest).

Participants agreed that aflatoxin contamination was a serious problem, and endorsed the recommendations of the 1987 International Workshop on Aflatoxin Contamination of Groundnut. Summary proceedings of this Workshop are now available in English, French, and Spanish. The full proceedings (in English only) will be published in 1989. ICRISAT is currently compiling a groundnut aflatoxin data base, and is collecting information on courses for training research workers in analytical methods for detection of aflatoxins and other technologies useful in mycotoxicology. Several genotypes with resistance to seed invasion by *A. flavus are* available from ICRISAT.

Recommendations

- A standard should be established for inspection of seed for aflatoxin contamination.
- Technology for groundnut production by small-scale farmers to reduce risk of aflatoxin should be worked out for different agroecological zones. This should incorporate (1) use of cultivars with seed resistance to colonization by *A .flavus,* (2) appropriate cultural and postharvest practices, and (3) methods to eliminate contaminated pods/seeds.
- International cooperative research into the aflatoxin problem should be encouraged.
- ICRISAT should take a leading role in making available *A. flavus* resistant cultivars, in collating and distributing research findings, and in arranging training courses.

Germplasm Collection and Adaptation

Chairman: J.C. Wynne, Co-Chairman: Sumarno

Most national programs are involved in germplasm collection, maintenance, and evaluation. However, cooperation between national programs in germplasm exchange has been limited by lack of information on material available in national collections and in the world collection maintained by ICRISAT.

Participants identified four major cropping systems in which groundnuts are produced in Asia—rainfed upland, lowland after rice (dry/irrigated), intercropped (with maize, coconut, sugarcane, rice, rubber, oil palm, etc.), and riverbank. Constraints to production in various countries were listed and prioritized on the basis of numbers of countries (n) concerned:

a. Leaf spots and rust (7)
b. Drought (6)
c. PStV(5)
d. Thrips and jassids *(Empoasca kerri),* soil insects, acid soil, lack of early-maturing cultivars, and cultivars tolerant of shade (4)
e. Waterlogging (2)

The listing of common problems indicated excellent potential for cooperative research efforts. Assistance currently available includes, in order from simplest to most involved, provision of the following:

a. Germplasm with tolerance of rust, late leaf spot, drought, jassids, and thrips, and with such other characters as large seed size and early maturity,
b. Hybrid material from specific crosses using adapted country cultivars and ICRISAT germplasm having specifically desired traits,
c. Segregating generations of crosses for selection by national programs, and
d. Homozygous breeding lines as observational nurseries (small quantities of seed), or as replicated international trials. The latter include early-maturing lines, rust and late leaf spot resistant lines, confectionery lines, thrips-and jassids- resistant lines, drought-tolerant lines, and medium- to late-maturing lines.

Only Thailand and the Philippines expressed interest in receiving early-generation segregating lines, the overall interest being in advanced generation breeding lines. It was noted that advanced lines may not be adapted if grown in environments with specific constraints such as bacterial wilt. Problems of seed production were discussed, and although each country has a system, there are serious problems in seed quantity and quality, and the costs involved in multiplication.

Recommendations

- Information on national germplasm collections should be made available through such publications as the International Arachis Newsletter, published by ICRISAT with support from Peanut CRSP.

- All countries and international organizations should cooperate in collecting landraces. These should be added to the world collection maintained at ICRISAT Center.
- ICRISAT should continue to provide both segregating and advanced breeding lines to national programs who, in turn, should supply ICRISAT with information on the performance of this germplasm in their countries.
- Specific subject matter working groups should be organized to address such constraints as drought, foliar diseases, virus diseases, bacterial wilt, insect pests, acid soils, and shade problems.
- Attempts should be made to resolve problems encountered in seed production.

Crop Production

Chairman: M. Bell, Co-Chairman: D.C. Cardenas

Crop production/agronomy of groundnut in Asia was considered under six categories—land preparation, plant population, fertilizer use, weed control, irrigation, and harvesting and threshing processes.

In India, Indonesia, and Thailand there are major problems in land preparation associated with the short turnaround period after the rice harvest and lack of suitable land tilling and sowing machinery. However, work is in progress in India and Thailand to evaluate and develop appropriate tools.

Sowing arrangements and plant populations differ both within and between countries. The lowest reported population was that of 125,000 plants ha^{-1} in Nepal (for Virginia types) and the highest was 440,000 plants ha^{-1} in India (for Spanish types). The major reasons cited for using high plant populations were (1) expectations of higher yields, (2) high seed and seedling mortality from disease and pest attacks, (3) low seed viability and germination, and (4) farmer's aversion to risk.

Except for a few situations, such as the irrigated lowland crop in India, farmers in Asia only rarely apply fertilizers to their groundnut fields. This is probably because of the unpredictable response of groundnuts to fertilizers and to the crop's ability to use fertilizer residues from previous crops. It is important that groundnut yield response curves be established for both macro- and micro-nutrient deficiencies.

All countries reported preference for manual weeding over the use of herbicides. In the Philippines, Thailand, and Malaysia the practice of "hilling up" is common. In the Philippines weeding is recommended as early as 2 weeks after sowing, but is not done later than 6 weeks after sowing to minimize damage to plants after pegging has started. High plant populations have been reported to reduce weed growth.

In India groundnuts are commonly grown in the dry season with flood irrigation (3-12 irrigations being given according to soil type). In the Philippines the critical periods of water need are at germination, flowering, pod initiation, and pod filling. A minimum of 4 irrigations is needed, and the water requirement of the crop grown in the

dry season is 500-600 mm. Research at ICR1SAT Center has shown that drought before flowering may increase yields.

Throughout the region, harvesting, threshing, and shelling are usually done manually. However, there is much interest in small-scale machinery. Mechanical threshers and shellers are being developed and/or evaluated in the Philippines, India, and Thailand. In India, diggers and planters are also being evaluated; interest in diggers being stimulated by reports that some 20-25% of pod yields in irrigated areas may be lost due to poor harvesting techniques.

Recommendations

- Attention should be given to the many agronomic problems occurring in the region, and this research, because of the location-specific nature of many of the problems, should be carried out within national programs.
- National research activities in groundnut agronomy, including development of machinery, should be reported in the International Arachis Newsletter and other newsletters as well as in appropriate journals.
- National programs should collect and document data on occurrence and importance of the various agronomic constraints within existing production systems.

International Cooperation and Training

Chairman: D.G. Cummins, Co-Chairman: R.C.N. Rao

Germplasm Exchange and Quarantine

All countries were interested in germplasm exchange, and all had quarantine regulations, the most strict being those of Australia. ICR1SAT and other International Agricultural Research Centers (IARCs) also have very comprehensive quarantine procedures. Seedborne viruses in groundnut are obviously important and necessitate effective quarantine. It is recognized that despite quarantine regulations, unofficial seed exchange and grain imports following natural calamities may result in spread of diseases and pests.

Recommendations

- The importation of multiple samples of identical seed material into a country should be avoided, thus reducing the chances of importing diseases and pests.

- Germplasm and lines with identified stress resistances or other favorable characters should be maintained within countries to reduce the need for fresh importations.
- Scientists receiving seed from other countries and external agencies should keep in touch with postal and customs authorities to expedite seed exchange. The most appropriate means of conveying seed material to specific countries should be documented.

Networks

The Asian Grain Legumes Network (AGLN) is an effective regional network, and the ACIAR and Peanut CRSP projects, although country-specific, are collaborating effectively to support groundnut research in the region. Information exchange is of vital importance and it is hoped that greater use can be made of existing newsletters such as International Arachis and the ACIAR Bacterial Wilt Newsletters. Personal communication between scientists should be encouraged.

The development of "working groups" to promote collaborative research was strongly supported and the following areas were identified:

- virus diseases
- bacterial wilt
- aflatoxin contamination and postharvest technology
- integrated pest management
- agronomy and crop physiology

Training

From the various kinds and levels of training available, country representatives placed the high priority on training in specific areas of research and/or special techniques, e.g., the ICRISAT in-service fellow system, and short courses of the type given in July 1988 on detection of groundnut viruses. Degree research and in-service training were also considered important. It was emphasized that in addition to looking toward IARCs for technical information and assistance, countries in the region need to interact among themselves to improve their capability to identify problems and conduct research.

Groundnut Research in Indonesia

Chairman: Sadikin Somaatmadja, Co-Chairman: N. Horn

Scientists from the Malang, Sukarami, and Maros Research Institutes for Food Crops presented a review of groundnut research activities in Indonesia. As the demand for groundnut in Indonesia exceeds supply, national priority has been given to increasing production. Primary production constraints in Java are water management problems, caused by poor soil structure and minimal tillage, and foliar diseases. In new areas of production in Sumatra constraints include soil acidity, low water-holding capacity, bacterial wilt, wild pigs, poor seed sources, and marketing problems. In Sulawesi, PStV, bacterial wilt, and drought are serious problems. All these constraints are being addressed, but several areas requiring specific research inputs were highlighted:

- PStV—More extensive surveys of PStV incidence combined with loss assessment studies could provide more accurate information on the extent of damage done by the disease. More research is required on the epidemiology of PStV.
- Rust and leaf spots—Research on the management of rust and leaf spots, important diseases in the region, should be increased. In resistance screening it is necessary to score genotypes at several stages during crop growth. Limited resistance in a high- yielding cultivar could be very useful.
- Bacterial wilt—Greenhouse screening techniques have been developed at the Bogor Research Institute for Food Crops, and field screening of germplasm from the PStV project should be continued. Lines with high resistance to bacterial wilt have been identified.
- Drainage—The broadbed and furrow system has potential for improving drainage in some soils.

Field Visit

The Director of MARIF organized a field visit to Jambegede Research Station south of Malang, where the following experiments were seen:

- Foliage disease control using fungicides. Compared to the nontreated control, reasonable improvements in control of foliage pathogens were achieved. The first of two harvests had already been made, showing yield increases as a result of fungicide use ranging from 19 to 47%. It was felt that disease control could be improved further, and the effectiveness of the application was questioned. Possible interactions between foliage pathogen management and crop maturity were discussed.
- Assessment of crop loss due to PSt V infection. Isolated plots had been artificially inoculated to varying extents. Infection spread is being monitored and yield will be assessed.
- Screening of ICRISAT germplasm for resistance to bacterial wilt in a wilt-sick field. Most entries were eliminated by the disease. Two of the control entries exhibiting some field resistance were identified as Virginia Bunch and Shulamit, which have both been introduced through the AARD/ACIAR project. However, both of these lines were of Spanish plant and pod type and misidentification appears to have occurred.

Plenary Session

Chairman: Y.L. Nene, Co-Chairman: C.L.L. Gowda

The Chairmen of the discussion groups presented their reports and the associated recommendations to the Plenary Session. There was further discussion, and the following points were raised.

1. The highlights on bacterial wilt of groundnut in the ACIAR Bacterial Wilt Newsletter should be included in the International Arachis Newsletter.
2. The research program on PStV is an excellent example of collaborative research involving many organizations, and this approach should be used for other problems.
3. A collaborative project involving ACIAR, Peanut CRSP, and ICRISAT should be initiated to survey the pest situation and assess associated yield losses in the Asia region.
4. ACIAR, Peanut CRSP, and ICRISAT should collaborate on acid soils research in Indonesia, the Philippines, Malayasia, and Thailand.
5. Thailand and the Philippines expressed interest in receiving early-generation segregating lines. Other countries needed advanced-generation breeding lines for direct testing.
6. National agricultural research programs should try to solve location-specific agronomic problems, with technical assistance from the international centers.
7. The importance of all seed exchange taking place through effective quarantine organizations was stressed. Scientists were urged to establish good contacts with customs and quarantine organizations to ensure rapid seed clearance. Where possible, the import of multiple samples of identical seed material should be avoided.
8. ICRISAT was asked to consider including other legumes (mung bean *(Vigna radiata),* soybean, *(Glycine max))* in the AGLN, as this would make the network more useful to the countries of the region.
9. A suggestion was made to collate relevant information on groundnut from different annual reports for dissemination to groundnut scientists.

Participants

Australia

Queensland Department of Primary Industries and ACIAR
P.O. Box. 23, Kingaroy, Queensland 4610
M.J. Bell, Agronomist
K.J. Middleton, Senior Plant Pathologist
G. Wright, Senior Agronomist

India

National Research Centre for Groundnut
Timbawadi P.O., Junagadh - 362 015, Gujarat
P.S. Reddy, Director

Indonesia

Ministry of Agriculture
East Java Province, Surabaya, East Java
Effendi Salam, Deputy Minister for Agriculture

Agency for Agricultural Research and Development
Jalan Ragwan 29, Pasarminggu, Jakarta Selatan
Soetatwo Hadiwigeno, Director General

Central Research Institute for Food Crops
Jalan Merdeka 99, Bogor 16111, West Java
H. Anwarhan, Agronomist and Head, Research Programming
Ibrahim Manwan, Director
Mahiyuddin Syam, Head, Research Communication

Bogor Research Institute for Food Crops
Jalan Cimanggu 3A, Bogor 16111, West Java
Sri Astuti Rais, Groundnut Breeder
M. Machmud, Plant Pathologist
Sumarno, Legumes Coordinator

Malang Research Institute for Food Crops
P.O. Box 66, Malang 65101, East Java
A.A. Cook, Legume Pathologist (Winrock)
F. Geurts, Team Leader (ATA-272 Project)
N. Horn, Virologist (ATA-272 Project)
Astanto Kasno, Plant Breeder
K.E. Neering, Entomologist (ATA-272 Project)
Augustina Rahmianna, Agronomist
Nasir Saleh, Virologist
Adi Sarwano, Agronomist
D. Sharma, Grain Legume Breeder (Winrock)
B. Soekarno, Plant Breeder
Sutaryo Brotonegoro, Director

Maros Research Institute for Food Crops
P.O. Box. 173, Ujung Pandang, Sulawesi
Mustari Basir, Plant Breeder

Sukarami Research Institute for Food Crops
P.O. Box. 34, Padang, West Sumatra
Abdul Gani, Plant Breeder

FAO/RAS/82/002 Project
Jalan Merdeka 99, Bogor 16111, West Java
Narong Chomchalow, Technical Adviser
Sadikin Somaatmadja, Regional Coordinator

Korea

Crop Experiment Station, RDA
Suweon, 440-100
Hee Woon Park, Researcher

RA-00142

Malaysia
Malaysian Agricultural Research and Development Institute
MARDI Station, Gajah Mati 06400,
Pokok Sena, Kedah
Siti Z. Ramawas, Groundnut Breeder

Nepal
National Oilseed Development Program
Nawalpur, Sarlahi District
B.P. Sharma, Asst. Plant Protection Officer

People's Republic of China
Oil Crops Research Institute
Chinese Academy of Agricultural Science
Wuchang Wuhan, Hubei Province
Sun Darong, Groundnut Breeder

The Philippines
Institute of Plant Breeding
University of the Philippines at Los Banos,
Laguna 403
R.M. Abilay, Researcher
Marina P. Natural, Plant Pathologist

Philippines Council for Agricultural Research and Resources Development,
Los Banos, Laguna
D.C. Cardenas,
Supervising Science Research Specialist

Thailand
Department of Agriculture
Bangkhon 10900, Bangkok
Sathorn Sirisingh, Entomologist

Department of Product Development,
Kasetsart University
Bangkhon 10900, Bangkok
Chintana Oupadissakoon, Food Scientist

Field Crops Research Centre
Khon Kaen
Anon Vatayanonta, Researcher

Faculty of Agriculture,
Khon Kaen University
Khon Kaen 40002
Aran Patanothai,
Leader, Groundnut Project (IDRC)
Sopone Wongkaew, Groundnut Pathologist

USA
University of Georgia and Peanut-CRSP
Georgia Experiment Station, Griffin,
GA 30223
L.R. Beuchat, Professor of Food Science
D.G. Cummins, Director, Peanut-CRSP
J.W. Demski, Virologist

North Carolina State University
Raleigh, NC 27695
W.V. Campbell, Professor of Entomology
J.C. Wynne, Peanut Breeder

Vietnam
National Institute of Agricultural Science
Hanoi
Tran Nghia, Plant Breeder

ICRISAT
J.R. Burford, Principal Soil Chemist
C.L.L. Gowda, Legumes Breeder
D. McDonald, Principal Groundnut Pathologist
R.C. Nageswara Rao, Groundnut Physiologist
Y.L. Nene, Program Director (Legumes)
S.N. Nigam, Principal Groundnut Breeder
J.A. Wightman, Principal Legume Entomologist

ICRISAT

International Crops Research Institute for the Semi-Arid Tropics

Patancheru, Andhra Pradesh 502 324, India

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