GROUNDNUT,
PEANUT, MANÍ,
ARACHIDE,
AMENDOIM,
MUNGPHALI.

International Arachis Newsletter

Prepared by
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o. 2

November 1987

● ICRISAT Center, Patancheru
• Other ICRISAT Locations
■ Peanut CRSP, Georgia
▪ Other CRSP Locations

International Arachis Newsletter

Publishing Objectives

The International Arachis Newsletter is issued twice a year (in May and November) by the Legumes Program, ICRISAT, in cooperation with Peanut Collaborative Research Support Program, USA. It is intended as a communication link for workers throughout the world who are interested in the research and development of groundnut *Arachis hypogaea*, or peanut, and its wild relatives. The Newsletter is, therefore, a vehicle for the publication of brief statements of advances in scientific research that have current-awareness value to peer scientists, particularly those working in developing countries. Contributions to the Newsletter are selected for their news interest as well as their scientific content, in the expectation that the work reported may be further developed and formally published later in refereed journals. It is thus assumed that Newsletter contributions will not be cited unless no alternative reference is available.

Style and Form for Contributions

We will carefully consider all submitted contributions and will include in the Newsletter those that are of acceptable scientific standard and conform to the requirements given below.

The language for the Newsletter is English, but we will do our best to translate articles submitted in other languages. Contributions that deviate markedly from this style will be returned for revision. Submission of a contribution that does not meet these requirements can result in missing the publication date. Contributions received by 1 February or 1 August will normally be included in the next issue.

If necessary, we will edit communications so as to preserve a uniform style throughout the Newsletter. This editing may lead to the shortening of some contributions, but particular care will be taken to ensure that the editing will not change the meaning and scientific content of the article. Wherever we consider that substantial editing is required, we will send a draft copy of the edited version to the contributor for approval before printing.

A communication should not exceed 600 words, and may contain a maximum of two relevant and well-prepared tables, figures, diagrams, or photographs. Each communication should normally be confined to a single subject and should be of primary interest to Arachis workers. The references cited should be directly relevant and necessary to supplement the article's content. All contributions should be typed in double spacing.

SI units should be used. Yield should be reported in kg ha^{-1}. A "Guide to Authors" is available from the Editor.

Address all communications, and requests for inclusion in the mailing list, to:

The Editor
International Arachis Newsletter
Legumes Program
ICRISAT, Patancheru
Andhra Pradesh 502 324, India

Cover illustration: *Arachis hypogaea* and some alternative names for groundnut.

CONTENTS

News and Views

Editorial

This is the second issue of the International Arachis Newsletter, and the first to contain regular items of news and views, research reports, and book reviews. The only news about groundnut scientists that I have received concerns ICRISAT scientists; so those items have been incorporated in the relevant ICRISAT reports. Please send me news about groundnut scientists, or newsworthy items about institutions working with groundnuts, to include in this section of forthcoming issues.

I have had a number of letters expressing appreciation of the newsletter, which is gratifying. One letter, printed in this issue, suggests publishing descriptions of pests and diseases, and although we can't do this for all diseases, we will accept reports of new pests or diseases. Please write to tell me what else you would like to see in the Newsletter.

J.P. Moss
Editor

Letters to the Editor

Dear Editor:

I acknowledge with thanks the receipt of the first issue of the International Arachis Newsletter and hope for its continuation.

I have a suggestion: please include and publish the photographs of all the major diseases and their field identification characters or keys, and the latest disease-loss rating scales, so that we can have authentic information gathered (at one place).

Sincerely yours,
M.S. Bhale
(Junior Scientist,
Department of Plant Pathology,
Jawaharlal Nehru Krishi Vishwa Vidyalaya,
Jabalpur, Madhya Pradesh 482 004, India)

Dear Mr Bhale:

Thank you for your suggestion, it helps us to know what you would like to see in the Newsletter. Unfortunately your suggestion is outside the capabilities of the newsletter.

At present, there is a well-illustrated Compendium of Peanut Diseases, *published in 1984 by the American Phytopathological Society, 3340 Pilot Knob Road, St. Paul, MN 55121, USA, from whom copies may be purchased.*

Also, ICRISAT has a series of Information Bulletins on groundnut pests and diseases that fulfill most of your requirements. To date, bulletins are available on Rust Disease of Groundnut, Early and Late Leaf Spots of Groundnut, *and* Pest Management in Stored Groundnuts. *Others dealing with important pests and diseases of groundnut are in preparation. Copies can be obtained from ICRISAT Information Services (see pp. 18-19 in the first issue of the International Arachis Newsletter for details).*

We would welcome articles on diseases and pests of groundnut for inclusion in the Newsletter.

--Editor

Dear Editor:

I read with great enthusiasm the article in the first issue of the International Arachis Newsletter on the suggested method of applying *Rhizobium* inoculum to groundnut seed.

I particularly want to know the ratio of water to inoculum recommended for making the slurry, and how the method can be applied in large-scale farming. More complete details of the method would be appreciated.

Has granulated inoculum been considered as an alternative? If so, how is it produced, and at what rate is it applied?

Sincerely yours,
R.C. Nyemba
(Soil Microbiologist,
Ministry of Agriculture and
Water Development, Research Branch,
Mount Makulu Central Research Station,
Private Bag 7, Chilanga, Zambia)

Dear Mr Nyemba:

Thank you for your letter and the questions on Rhizobium *application to groundnut seed.*

To prepare the slurry, we add 1 g of peat containing approximately 10^9 *cells of* Rhizobium *to 1 L of water. The slurry can then be applied to the seed*

furrow at the rate of 5 mL seed^{-1} using a suitable dispenser. For large-scale application, we have developed an attachment for use with an animal-drawn country plow. This is simply a container attached to the frame of the plow from which a tube carries the inoculum down into the furrow and deposits it close to the seed.

Granulated inoculum may also be used. It is prepared by mixing 70 g of the peat-based inoculum (containing 10^9 cells g^{-1} to 10^{10} cells g^{-1} of peat) with 800 mL of aqueous methyl cellulose (1.5%) and mixing this with 5.5 kg of washed river sand, and air-drying this for 8-12 h in the shade. This granulated inoculum is then applied to the soil below the seed at a rate of 1-2 g seed^{-1} (giving 10 Rhizobium *cells seed^{-1}) at the time of sowing.*

--Editor

News from ICRISAT Center

The 1987 Rainy Season--A Below Average One

ICRISAT Agroclimatology Research Unit reports that rainfall at ICRISAT Center has been below average during the 1987 rainy season (Fig. 1). The average rainfall at the Center in the past 86 years has been 780 mm (standard deviation, 210 mm). During that time, there were 14 dry years (<570 mm) and 10 wet years (>990 mm). The year 1985 was dry (504 mm), and 1986 below average (716 mm).

From 1 January to 9 October 1987, rainfall amounted to 623 mm, 12% below the long-term average. Rainfall from June to September was 447 mm, 28% below average. Rainfall in September was 62 mm, 66% below average. However, rainy-season crops planted in early June particularly in Vertisols have given good results. Solar radiation was also below average during August. There were more than 15 days in August when solar radiation ranged from 10 to 15 MJ m^{-2} day^{-1}, when about 20 MJ m^{-2} day^{-1} would have been better for crop growth.

The total rainfall in October and November was 389 mm against the long-term average of about 90 mm. This rainfall has been useful for postrainy-season cropping.

Asian Grain Legumes Network

The Asian Grain Legumes Network (AGLN) was established in January 1986, to provide a means whereby the national agricultural scientists in South and Southeast Asia can effectively utilize the plant materials and other related technology available at ICRISAT for improving yield levels of groundnut, chickpea, and pigeonpea.

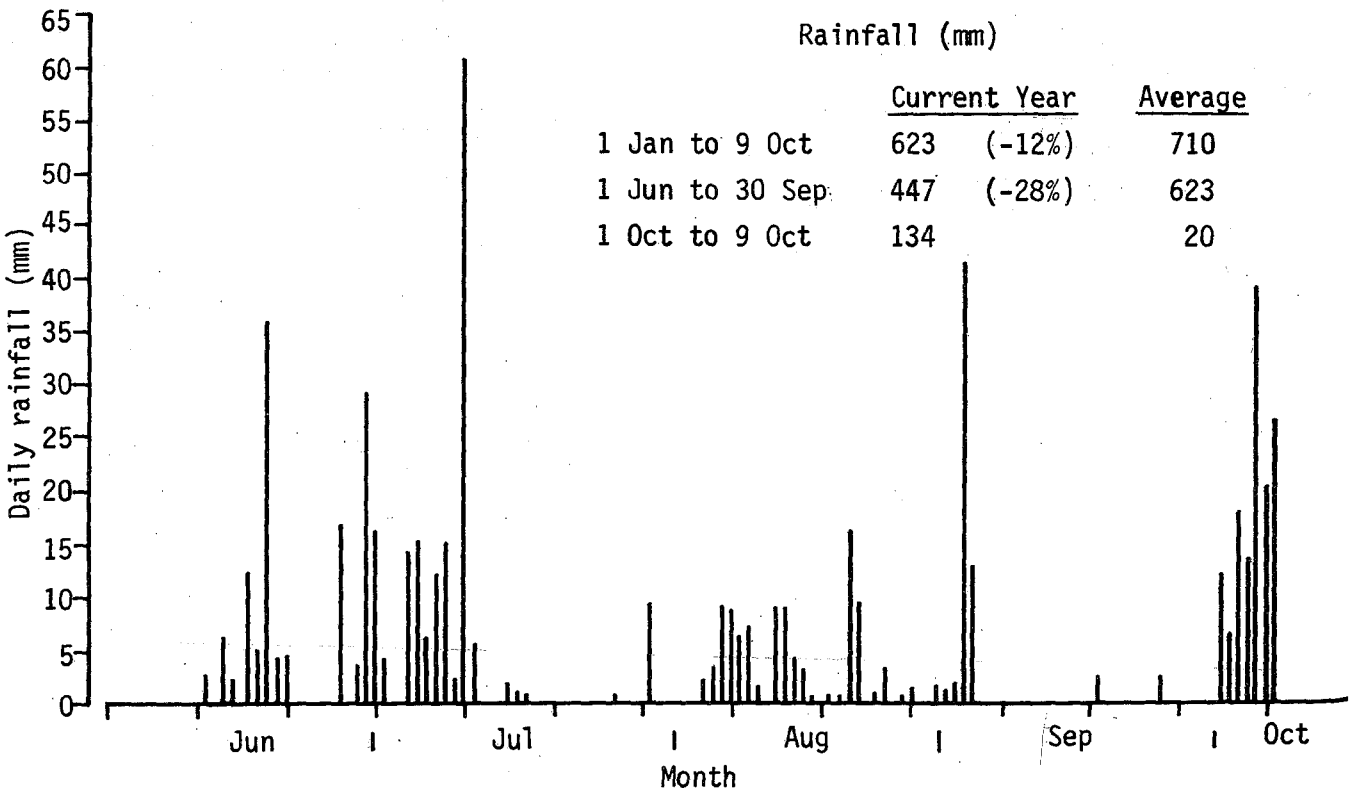

Figure 1. Rainfall at ICRISAT Center from 1 Jun 1987 to 9 Oct 1987.

This will involve 10 countries: Bangladesh, Burma, India, Indonesia, Nepal, Pakistan, the People's Republic of China, the Philippines, Sri Lanka, and Thailand. Apart from plant material and technology, the AGLN proposes to provide relevant literature, training, consultancies, and funds for procuring equipment for proper conduct of trials or for attending meetings arranged or sponsored by ICRISAT.

Phase I of AGLN activities is operational in four South Asian countries (Bangladesh, Burma, Nepal, and Sri Lanka) with funding from the Asian Development Bank (ADB). Pakistan has a trilateral arrangement on chickpea improvement, involving ICRISAT, ADB, and the Pakistan Agricultural Research Council. The assistance will provide crucial financial support to national programs to effectively test the material and technology on those crops, and to remove bottlenecks in adoption of new technology.

The AGLN arranged 'Work-Plan Meetings' in Burma, Bangladesh, Nepal, Pakistan, and Sri Lanka during July-August 1987. The AGLN staff discussed with national scientists and administrators the constraints to production and the research needs, and prepared an annual 'Work Plan' for each country.

Legumes On-Farm Testing and Nursery Unit Set Up

The Legumes On-Farm Testing and Nursery Unit (LEGOFTEN) was set up by the ICRISAT Legumes Program on 1 June 1987. In the 1987 rainy season, the Unit assisted the Government of India in carrying out demonstrations in a number of states on agronomic practices to improve yields of groundnuts.

The high-input package of practices (high-yielding variety with good crop husbandry) that was designed to overcome the various constraints at different locations and demonstrates the groundnut yield potential, is being tested in five Indian states. The ICRISAT package of practices is being compared with the state-recommended and local cultivation practices. These demonstrations have generated a great deal of interest with the farmers, extension workers, and administrators. Frequent visits by LEGOFTEN scientists serve an important objective of identifying problems as soon as they arise, recommending remedial practices, and bringing back the information for further analysis. Some of the problems include difficulties in forming the recommended raised beds and furrows, lack of a good seed drill, severe nutritional deficiencies, problems associated with acidic soils, and some hitherto unsuspected seedling pests and diseases. When necessary, these problems are referred to ICRISAT groundnut scientists. These trials have highlighted the importance of sound crop husbandry based on constraint analysis as well as the importance of using high-yielding cultivars. Similar trials are planned for the postrainy season in six Indian states.

The LEGOFTEN unit hopes to extend its efforts in improving the yields of pigeonpea and chickpea, the other two mandate legume crops of ICRISAT, if ICRISAT is asked, as in the case of groundnut.

Although the high-input technology evolved at ICRISAT can give high yields of all the three legumes, the technology must be made cost-effective, and applicable to the situation in the farmers' fields.

LEGOFTEN staff will be reporting in detail on the constraints which reduce yields in farmers' fields, and it is hoped that the knowledge gained in India will be applicable, at least in part, to other countries.

News about ICRISAT Center Groundnut Scientists

P.W. Amin, Groundnut Entomologist, was appointed Coordinator, Legumes On-Farm Testing and Nursery Unit (LEGOFTEN), on 1 June 1987.

* * *

D.G. Faris, Principal Coordinator, Asian Grain Legumes Network (AGLN) of ICRISAT has proceeded on sabbatic leave from September 1987. During his leave, he will be studying the existing scientific networks in different countries, and will develop a model network for operation of the AGLN. After initial work at IDRC, Ottawa, Canada, he will visit different international research organizations in meso-America and Africa. He will spend the last part of his leave at the International Rice Research Institute, the Philippines to formulate a suitable network and write up his work.

During his absence, Plant Breeder (Chickpea) **C.L.L. Gowda,** is Acting Coordinator, AGLN.

* * *

D.L. Oswalt, Principal Training Officer, and **F. Singh,** Training Officer, are responsible for the trainees who come to ICRISAT, many of whom are involved with groundnut. Drs Oswalt and Singh have close links with the Legumes Program and with groundnut scientists, with whom they consult to provide the best training available.

* * *

R. Jambunathan, Principal Biochemist, is Head of the Biochemistry Unit, where groundnut samples are analyzed for a wide range of nutritional factors.

* * *

ICRISAT's new Nematology Laboratory was inaugurated by Director General **L.D. Swindale** on 21 August 1987. Plant Nematologist **S.B. Sharma** is in charge of the laboratory.

The facility will enable processing of soil and root samples collected from fields where ICRISAT mandate crops are grown. Nematodes will be isolated and identified from such samples for further laboratory, greenhouse, and field experiments. The laboratory has a special facility to kill nematodes in water suspension before effluents are discharged into the drainage system.

News from the ICRISAT Sahelian Center

Season. Our first cropping season at the ICRISAT Sahelian Center (ISC) has been characterized by delayed onset of planting rains followed by atypical erratic rains. In June, we received only 15.9 mm of rainfall, almost all of which fell on 1 June. This was then followed by a 20-day dry period before a 2-mm rain was received on 21 June. Although July received 82.4 mm of rainfall this was again below the long-term average. Most trials were planted by the middle of July. The rainfall received in August was 252.2 mm and most of this came in three rainstorms. Till the end of August total rainfall was 34% below the long-term average. This has had serious implications for crop growth and development.

The situation elsewhere is encouraging. Although the total rainfall received at Bengou (300 km south of Niamey) is much below the long-term average, the distribution has been better and the crop growth good.

Performance of ICRISAT varieties in Niger. In a variety trial conducted by the Institut national de recherches agronomiques du Niger (INRAN) at Maradi in 1986, ICGV 87123 (ICGS 11) was the top-yielding variety in the first sowing and significantly outyielded the control, 55-437, in the second sowing. ICGV 87123 (ICGS 11) is being further tested by INRAN.

In trials conducted by ICRISAT's Resource Management Program at Sadoré and Bengou, ICGV 86063 (ICGS(E)-30) showed promise in an early sowing at Sadoré and a late sowing at Bengou. ICGV 86072 (ICGS(E)-55) was the top yielder in a later sowing at Sadoré.

Peanut CRSP scientists visit Niger. Dr T. Nakayama, Director, Peanut CRSP and Dr Bharat Singh of the Peanut CRSP visited the ISC, Sadoré, and held discussions with ICRISAT scientists Drs D.C. Greenberg, P. Subrahmanyam, and B.J. Ndunguru on groundnut production constraints, research collaboration, and international development.

Dr O.D. Smith of the Texas A & M University/Institut sénégalais de recherches agricoles/University of Ouagadougou Institut Superior Polytechnique/Peanut CRSP project in West Africa, visited Niger in August 1987. He was accompanied by Mr W.J. Grichar, Research Scientist, Texas Agricultural Experiment Station, Yoakum, TX, USA.

Dr Smith and Mr Grichar conferred with ICRISAT's Executive Director (West Africa) and Director ISC R.W. Gibbons, Principal Groundnut Pathologist P. Subrahmanyam, Principal Groundnut Breeder D.C. Greenberg, and Principal Groundnut Agronomist B.K. Ndunguru about the production constraints in West Africa. They visited groundnut trials at Sadoré, Bengou, and Maradi. They also visited several farmers' fields in southern Niger. They discussed the results of the INRAN-Peanut CRSP collaborative trials with INRAN Groundnut Breeder A. Mounkaila and INRAN Plant Pathologist H. Hassane at Maradi.

ICRISAT Regional Groundnut Program for Southern Africa

New Groundnut Breeder Joins the Program

Dr G.L. Hildebrand joined the ICRISAT Regional Groundnut Program for Southern Africa as Principal Groundnut Breeder in August 1987. Dr Hildebrand who is from Zimbabwe, has 20 years of experience in groundnut breeding research in that country. He has bred and released six cultivars. Lately he has been working on breeding for resistance to the early leaf spot/web blotch disease complex, which is important in Zimbabwe and some other areas of southern Africa.

News from Peanut CRSP

Peanut Collaborative Research Support Program (CRSP) scientists J. Demski, C. Kuhn, S. Misari, and O. Ansa attended the Meeting for Collaborative Research on Groundnut Rosette at Lilongwe, Malawi on 8-10 March 1987. The meeting was sponsored by ICRISAT.

J. Demski participated in the Peanut Stripe Virus Coordinators' Meeting in Malang, Indonesia, 9-12 June 1987.

A Peanut CRSP meeting was held on July 17 at Orlando, Florida, USA. Representatives of United States of Agency for International Development (USAID), Board for International Food and Agricultural Development (BIFAD), and ICRISAT discussed the origin and present state of CRSP, prospects for the future, and coordination with ICRISAT. The meeting was held at the close of the annual American Peanut Research and Education Society meeting. Approximately 50 persons attended the meeting.

The Peanut CRSP sponsored a Peanut Utilization Symposium at the 7th World Congress of

Food Science and Technology in Singapore, 28 September-2 October. Speakers were from Indonesia, Malaysia, the Philippines, Taiwan, Thailand, and USA.

A "Decade Two Preparation" workshop involving program directors, managers, and representatives of the technical committees, external evaluation committees, and boards of the eight CRSPs was held in Washington D.C., USA, 13-14 July 1987. Discussions involved attempts to decrease duplication and increase coordination communication between CRSPs, International Centers, and missions, and to work more effectively with national programs.

Reports

Groundnut Virologists Visit Texas

D.H. Smith (Texas Agricultural Experimental Station, P.O. Box 755, Yoakum, Texas 77995, USA)

D.V.R. Reddy (Principal Virologist, ICRISAT Center), Dr P. Sreenivasulu (Reader in Botany, Sri Venkateswara University, Tirupati, Andhra Pradesh, India), and Dr M. Dollet [Head of Virology Division, Centre de coopération internationale en recherche agronomique pour le développement (CIRAD), Montpellier, France], visited Frio and Atascosa counties of Texas in July 1987. They observed tomato spotted wilt virus disease (bud necrosis) in both counties. They visited the field plots where groundnut genotypes from ICRISAT Center (India), North Carolina (USA), Florida (USA), South America, and Africa are being evaluated for resistance to tomato spotted wilt virus. They discussed with scientists from Texas A&M University the recent epidemics of bud necrosis in Texas.

Dr Sreenivasulu is on sabbatical leave at the Georgia Experiment Station in Experiment, Georgia. Dr J.W. Demski, Professor, University of Georgia, and Dr Sreenivasulu are conducting research on bud necrosis and other important groundnut virus diseases in the US.

Prior to their trip to Texas, each of the scientists participated in the American Peanut Research and Education Society annual meeting in Orlando, Florida. Drs Reddy and Dollet presented papers on the tomato spotted wilt virus disease in groundnut at the meeting.

Peanut Stripe Virus Meeting

Nineteen scientists, from Australia, Indonesia, Japan, the Philippines, and Thailand, as well as from four organizations--Australian Centre for International Agricultural Research (ACIAR), Food and Agriculture Organization of the United Nations (FAO), Peanut CRSP, and ICRISAT--participated in the Peanut Stripe Virus (PStV) Coordinators' Meeting in Malang, Indonesia from 9 to 12 June. The meeting was sponsored by ICRISAT through the Asian Grain Legumes Network and financed by the Australian Development Assistance Bureau through an ACIAR/ICRISAT grant, Peanut CRSP, and ICRISAT. Five country papers, 3 special papers, and 10 discussion papers were presented. There was also a demonstration of a simple ELISA test procedure for identifying the presence of PStV.

The causal virus of PStV disease was only identified 3 years ago but has since been observed in groundnut in Southeast Asia. It is also present in USA, where it was introduced in seed imported from eastern Asia. Existing literature on this disease is confused because the disease is recently detected and its various isolates show a range of symptoms. From this meeting will come a "letter" in an international journal aimed at clearing up this confusion.

The meeting also put forward a series of other recommendations for research designed to give a clearer picture of this virus, including its mode and extent of spread, alternate hosts, range of symptoms, and yield loss assessment. The meeting also recommended that efforts be made to provide training in identification of the virus, and to find sources of resistance. The latter objective is being addressed by a program to screen this year over 6500 groundnut lines from ICRISAT for resistance to PStV in Indonesia.

Information is also being provided to National Quarantine Services to help prevent further spread of the disease as it is seedborne. This is important as this disease may not be present in Australia, and some countries in South Asia.

Cultivation and Research Activities in Cyprus

I. Papastylianou (Agricultural Research Institute, Nicosia, Cyprus)

Groundnuts were grown in western Cyprus up to the early 1980s on a very small scale, in less than 200 ha. With the commissioning of a new irrigation project, the cultivation of groundnut increased and now occupies nearly 1000 ha a^{-1}. An important factor in the expansion of groundnut cultivation was the introduction of mechanization of sowing and harvesting.

In western Cyprus, groundnuts, along with french beans and potatoes, are the main irrigated summer crops. In the late 1970s nearly 100 t of groundnuts were imported every year, but now domestic production, which has reached 2400 t, covers the needs of the country and a surplus of 100 t of groundnut was exported in 1986.

In Cyprus, groundnuts are mainly consumed roasted as a snack and in the confectionary industry. Groundnut is not commonly used for cooking. There is no oil industry. Therefore, only confectionary, large-seeded types are cultivated. Future development of the groundnut-oil industry will stimulate groundnut cultivation, since at present all groundnut oil, which is very popular, is imported.

Farmers are advised by the extension services of the Ministry of Agriculture on details of groundnut cultivation by personal contacts, specific publications (Constantinou 1982), and by the quarterly journal *Agrotis*. The extension services, in cooperation with the farmers, investigated and introduced mechanized sowing and harvesting of the crop.

Research Activities

The sudden expansion of groundnut cultivation led to numerous research projects to find ways for better cultivation and higher productivity. Most of the experimental work is still in progress. Some of the preliminary results are reported below.

Irrigation study (Mr Ch. Metochis). Four amounts of water, representing 0.6, 0.8, 1.0, and 1.2 x ETP (290, 385, 480, and 575 mm), were applied to a local groundnut variety, seeded in late April. Irrigation, by a permanent low-discharge sprinkler system, was applied following crop establishment (about 50 days after seeding). The frequency of water application was based on pan evaporation, and ranged from 14 days in late June and late August to 10 days in July and early August. Eight waterings were given. The crop was harvested in late September, about 3 weeks after irrigation was discontinued. The optimum amount of irrigation water was 480 mm. Amount of water did not affect kernel mass (0.9 g $kernel^{-1}$) or the kernel/pod ratio (67%).

The effect of irrigation during the establishment period of the crop was also tested. Three irrigation treatments were applied: (a) first irrigation at 48 days; (b) irrigation at 24 and 48 days; (c) irrigation at 16, 32, and 48 days from seeding. The amount of water applied each time was the irrigation requirement after the previous water application. Crop development and yield were similar under all treatments, and there was no chlorosis (Agricultural Research Institute 1987).

Cultivar evaluation (Dr A. Hadjichristodoulou). The "local" cultivar, which belongs to the virginia spreading-bunch type, gives satisfactory yields with kernel quality that is acceptable to the consumer.

The aim of introduction and evaluation is mainly to screen for cultivars with better yield than the local cultivar and suitable for roasting.

The introduction and evaluation of groundnut cultivars under Cyprus conditions were initiated on a large scale after 1980.

Cultivars were introduced from ICRISAT, USA, and Israel. The results show that it is possible to increase kernel yields by 10-32% with varieties producing kernels of similar size or even up to 16% larger in kernel mass compared to the local variety. Varieties such as ICGV 87122 (ICGS-6), ICGV 87134 (ICGS-61), ICGV 87126 (ICGS-30), and ICGV 87121 (ICGS-5), which produce kernels of a smaller size [650 g $(1000\ kernels)^{-1}$], can give production up to 64% higher than the local cultivar (Hadjichristodoulou 1987).

Chlorosis of groundnuts (Dr I. Papastylianou). Especially in the Yeroskipou and Kouklia areas, groundnuts suffer from severe chlorosis, which may be so severe that the farmers have to abandon the crop. A soil and plant survey of farmers' fields showed that chlorosis was due to high $CaCO_3$ in the soil, and could not be correlated with soil-mineral nitrogen.

Six field experiments and five small demonstrations conducted in farmers' fields showed that:

(a) soil application of iron chelates cures chlorosis and results in maximum yield (4000-6000 kg ha^{-1});
(b) the best time to apply chelates is prior to the first irrigation, approximately 30 days after sowing;
(c) chelates should be applied only to crops showing obvious chlorosis symptoms;
(d) in the Yeroskipou area plots with severe chlorosis at the time of chelate application gave no yield without Sequestrine 138 Fe treatment but gave 4120 kg ha^{-1} with the application of 20 kg ha^{-1} of Sequestrine 138 Fe, 4920 kg ha^{-1} with 40 kg ha^{-1} of Sequestrine 138 Fe, and

5390 kg ha^{-1} with 80 kg ha^{-1} of Sequestrine 138 Fe, and in the Mandria area, plots with moderate chlorosis gave a yield of 3280 kg ha^{-1} without chelate application, 4180 kg ha^{-1} with an application of 20 kg ha^{-1} of chelates, 4690 kg ha^{-1} with 40 kg ha^{-1} of chelates, and 5360 kg ha^{-1} with 80 kg ha^{-1} of chelates; and

(e) among four different chelates tested, the ones having EDDHA as chelating agent gave the best results (Agricultural Research Institute 1987).

***Rhizobium* inoculation** (Dr I. Papastylianou). A survey in the Paphos area showed that groundnuts have few or no nodules, an indication that they depend on N supplied by the soil and by fertilizers. *Rhizobium* inoculum introduced from ICRISAT was tested. The treatments were:

(a) seed inoculated with Rhizobium without nitrogen fertilization,

(b) noninoculated with 240 kg N ha^{-1}, with the fertilizing split in three doses, and

(c) noninoculated, nonfertilized. Pod yields were: 3010 kg ha^{-1} for treatment 'a', 3440 kg ha^{-1} for 'b', and 2140 kg ha^{-1} for 'c' (Agricultural Research Institute 1987).

Spacing (Drs A. Hadjichristodoulou and I. Papastylianou). Within-row spacing studies showed that 10-cm distances between plants resulted in pod yields of 4.8 t ha^{-1}, 15 cm between plants in 4.2 t ha^{-1}, 20 cm between plants in 4.5 t ha^{-1}, and 25 cm between plants in 3.9 t ha^{-1}. Distance between rows was 60 cm (Hadjichristodoulou 1987). Spacing studies examining distances between and within row are being continued.

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Constantinou, D. 1982. The cultivation of peanuts (in Greek). Publication 15/1982. Department of Agriculture, Cyprus. 18 pp.

Hadjichristodoulou, A. 1987. Cultivar and spacing trials with peanuts. Technical Bulletin No.94. Agricultural Research Institute, Nicosia, Cyprus.

Research Reports

Arachis Germplasm Collection in Northeastern Brazil

V. Ramanatha Rao[1] and **J. F. M. Valls**[2]
(1. ICRISAT; and 2. Centro Nacional de Recursos Geneticos (CENARGEN)/Empresa Brasileira de Pesquisa Agropecuaria (EMBRAPA), CP 10.2372, SAIN, Parque Rural, Brasilia, DF., Brazil)

Brazil is a major area of diversity for the genus *Arachis*. The country has been accorded high priority for collection of germplasm. As the country is large, several collection missions have been made there and a considerable amount of germplasm collected by various workers including Drs Krapovickas, Gregory, Hammons, Simpson, and the authors (Valls et al. 1985). However, certain parts of Brazil are yet to be explored adequately and the proposals put forward by the Centro Nacional de Recursos Geneticos (CENARGEN) of the Empresa Brasileira de Pesquisa Agropecuaria (EMBRAPA), Brazil are supported by the International Board for Plant Genetic Resources and ICRISAT. ICRISAT scientists have participated in some of the collection missions.

During April 1987, a joint *Arachis* collection mission was undertaken by ICRISAT and CENARGEN/EMBRAPA in northeastern Brazil. The objectives of the mission were to collect *Arachis* germplasm in northeastern Brazil and to observe wild *Arachis* species in their native habitat. The collection team consisted of Dr J.F.M. Valls and Mr P.G. Silva of CENARGEN/EMBRAPA and Dr V. Ramanatha Rao of ICRISAT.

Northeastern Brazil is the home of four *Arachis* species in sections *Extranervosae, Ambinervosae, Triseminalae,* and an unnamed section (Prof A. Krapovickas, Universidad Nacional del Nordeste, Argentina, personal communication, 1987). In the

present expedition, areas in the states of Bahia, Pernambuco, Ceará, Paraiba, Rio Grande do Norte, and Piauí were explored. We sampled 44 *Arachis* populations which included samples with seeds and herbarium specimens (32), live plants and herbarium (2), only herbarium (3), and cultivated groundnut (7). These comprised 8 collections of *A. sylvestris*, 23 of species in section *Ambinervosae* (including *A. dardanoi* Krap. & Greg. *nom. nud.*), 2 species in section *Extranervosae*, 4 unknown species, and 7 cultivated collections of *A. hypogaea* subsp *fastigiata* var *fastigiata*.

During this mission, large areas previously unexplored or inadequately explored were covered. We did not find any *Arachis* (section *Triseminalae*) near Jacobina, which has been described as the type locality for a species in this section. We assumed that this location was wrongly described. The samples, VRSv 10922, 10923, 10932, and 10933 consisted of mixed populations of species showing variation for hairs on the upper surface of the leaf, and for presence and arrangement of glandular bristles on the lower surface. These may contain species belonging to sections *Ambinervosae* and *Extranervosae*.

Collection of *A. sylvestris* at 15 km northeast of Currais Novos and around Fortaleza near sea level, extends the distribution of this species to further north and northeast than was previously known. Its presence at Tiangua (720 m altitude) makes it one of the *Arachis* species with the largest geographic distribution. *A. dardanoi* Krap. & Greg. *nom. nud.* (section *Ambinervosae*), of which the maximum number of samples were obtained, is now fairly well collected over a large area in northeastern Brazil. Its western limit in the northeast appears to be somewhere beyond Sobral. Another species, (VRSv 11028), belonging to section *Extranervosae*, is well distributed in the basins of the Araguaia and Tocantins rivers. In the north, its limit appears to be about 100 km east of Teresina.

Accession VRSv 10921, though very similar to *A. sylvestris*, has a distinctive arrangement of glandular bristles on the lower surface of the leaf, in an inverted form of 'U'. VRSv 11022 was also similar. However, *A. sylvestris* (VRSv 11020) had bristles distributed all over the lower surface of the leaf. We assumed that this is only intraspecific variation, but this needs further study for confirmation.

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A Strategy for Maximizing Productivity of Groundnut

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Of about 250000 ha under groundnut (*Arachis hypogaea* Linn.) cultivation in Rajasthan, India, nearly 100000 ha are in a typical semi-arid tropics (SAT) region covering the districts of Jaipur, Sawaimadhopur, Ajmer, and Tonk. Cultivation of groundnut in this area is predominantly rainfed though many farmers there have potential sources of irrigation. The groundnut sowing start with the commencement of monsoon rains in the 2nd to 3rd week of July.

It is well known that the groundnut crop is able to withstand drought stress during early stages of growth, and it is therefore implied that groundnut sowing could be taken up well ahead of the probable dates of monsoon break, where irrigation is available, in order to establish the crop and utilize the full growing season.

Trials conducted at this research station showed that the best yields are obtained when the crop is sown in the 1st fortnight of June with a presowing irrigation. The data on breeding trials, conducted under the All India Coordinated Oilseeds Research Project (AICORPO), confirm the above facts. In the present note, interpretations have been derived from 10 years' data, based on breeding trials involving several genotypes in each group, of which 8 years' data (1977-84) pertain to the sowings done in the 2nd to 3rd week of July (normal sowing) and the 2 years' data (1985-86) have been derived from sowing done around mid-June (advanced sowing).

The data presented in Table 1, which are the means of several genotypes in each group, indicate that there was 73% increase in pod yield for spanish bunch (SB), 67% increase for virginia bunch (VB), and 65% increase for virginia runner (VR) groups, when average yields of normal sowing were compared with advanced sowing. However, if 2 years' advanced sowing yields are compared with the 2 best years of normal sowing trials, then the increases in the former were recorded as 37% over the latter for SB groups, 21% over the latter for VB groups, and 30% over the latter for VR groups. The reasons for high yields from advanced sowing are perhaps the early flowering and more judicious water use during the long seed-filling phase. The data further indicate that advanced sowing is more beneficial for spanish types, which perhaps is due to their early flowering and long seed-filling phase.

The foregoing data clearly reveal that wherever possible, the groundnut crop should be planted early with a presowing irrigation, to maximize productivity under rainfed conditions in Rajasthan.

Table 1. Crop duration (days) and pod yields (kg ha^{-1}) of groundnut trials conducted at Agricultural Research Station, Durgapura, rainy seasons (kharif), 1977-86.

Year	Date of sowing	Mean crop duration			Mean pod yield		
		SB	VB	VR	SB	VB	VR
1977	12 July	122	132	141	1700	2218	1437
1978	17 July	115	130	139	1465	949	1854
1979	20 July	120	132	137	646	940	720
1980	10 July	120	133	142	1187	1203	1453
1981	17 July	125	140	152	1290	-	1880
1982	16 July	124	140	144	1700	2387	2280
1983	31 July	120	132	143	1765	2075	1982
1984	12 July	119	133	142	1982	2432	1893
Mean yield of 8 years (normal sowing)					1461	1743	1692
Mean yield of 2 best years					1848	2409	2485
1985	20 June	115	123	132	2471	2650	2640
1986	20 June	114	124	134	2578	3160	2927
Mean yield of 2 years (advance sowing)					2524	2905	2784
Grand mean yield					1992	2324	2135
Increase of advance sowing over normal sowing					73%	67%	65%
Increase over 2 best seasons					37%	21%	30%

Efficacy of Oxyfluorfen for Weed Control in Irrigated Groundnut

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Groundnut (*Arachis hypogaea* Linn.) needs a weed-free period for the first 30-40 days after sowing to reduce the competition from weeds (Krishnamurthy et al. 1981). Generally, groundnut suffers from competition by grasses, particularly *Dactyloctenium* spp, *Digitaria* sp, *Panicum* spp *Echinochloa colona* L., *Eragrostis* sp in red soils, and yield reduction of 18-53% is reported due to weeds (Kulkarni et al. 1963; Krishnamurthy et al. 1981). Herbicides like alachlor (1.0 to 1.5 kg a.i. ha^{-1}), nitrofen (1.0 kg a.i. ha^{-1}), and fluchloralin (0.68 kg a.i. ha^{-1}) as preemergence applications have proved effective for weed control in groundnut (Kuldeep Singh et al. 1972; Sankara Reddi et al. 1976). To examine the efficacy of a new herbicide, oxyfluorfen [2-chloro-1-(3-ethoxy-4-nitrophenoxy)-4-(trifluor-methyl) benzene], it was compared at various doses for the control of weeds in irrigated groundnut in a red sandy loam soil.

A field study was conducted in summer, 1983, using the cultivar TMV 2 at Hebbal, by the University of Agricultural Sciences, Bangalore. Eight weed control treatments (Table 1) were compared in a randomized-block design layout with three replications. A fertilizer dose of 25 N kg ha^{-1}, 75 P_2O_5 kg ha^{-1}, and 37.5 K_2O kg ha^{-1}, and a spacing of 30 cm x 10 cm were followed using a plot size of 3.6 m x 3.0 m. Herbicides were sprayed a day after sowing as a preemergence application.

The major weeds observed in the experimental plots were a sedge, *Cyperus rotundus* L.; the grasses, *Dactyloctenium aegyptium* Picht., *Digitaria marginata* (Link.), *Eragrostis pilosa* Beaur., and *E. riparia* L.; and the dicotyledons, *Tridax procumbens* Linn. and *Amaranthus viridis* L. At all stages, sedges dominated, followed by grasses, and then by broadleaf weeds. In all, 34 weed species were observed of which 1 belonged to sedges, 12 to grasses, and 21 to the broadleaf category. Increased dosage of oxyfluorfen decreased the density of most grasses as well as of broadleaf weeds except *Commelina benghalensis* L. Oxyfluorfen at 0.12-0.15 kg ha^{-1} was effective on both grasses and broadleaf weeds, whereas fluchloralin was more selective on grasses than broadleaf weeds. With advance in growth, new major weeds like *Setaria glauca* L., *E. riparia* L., and *Oldenlandia corymbosa* L. made their appearance.

Table 1. Performance of oxyfluorfen for weed control in groundnut, at Hebbal, University of Agricultural Sciences, Bangalore, summer 1983.

Treatment (kg a.i ha^{-1})	Pod yield (kg ha^{-1})	Cost of treatment (MC) (Rs ha^{-1})	Marginal returns (MR) (Rs ha^{-1})	MR/MC	Weed dry mass 60 DAS[1] [g $(0.25\ m)^{-2}$]		
					Monocots	Broad-leaf	Total
T1 Oxyfluorfen 0.06	2988	130	1827	14.0	26.9(5.1)[2]	1.1	28.0(5.2)[2]
T2 Oxyfluorfen 0.09	3057	180	2034	11.3	20.9(4.5)	1.0	21.9(4.6)
T3 Oxyfluorfen 0.12	3206	230	2481	10.8	12.6(3.6)	0.7	13.3(3.7)
T4 Oxyfluorfen 0.15	3241	280	2586	9.2	14.5(3.7)	0	14.5(3.7)
T5 Oxyfluorfen 0.18	3253	330	2622	7.9	25.0(5.0)	3.5	28.5(5.3)
T6 Fluchloralin 0.68	3287	238	2724	11.4	16.0(3.9)	3.2	19.2(4.3)
T7 Hand weeding and hoeing (25-30 DAS)	3034	550	1965	3.6	20.2(4.5)	0.4	20.6(4.6)
T8 Unweeded control	2379	-	-	-	45.9(6.7)	0.6	46.5(6.8)
CD ($P = 0.05$)	563				(1.7)	NA[3]	(1.7)

Cost of 1 L of oxyfluorfen = Rs 400. Cost of 1 L fluchloralin = Rs 145. Cost of 1 kg groundnut pods = Rs 3. Cost of labor = Rs 8.50 day^{-1}.

1. DAS = Days after sowing.
2. Values within the parentheses are in $/x+0.5$ transformed unit.
3. NA = Not analyzed.

Due to effective weed control up to 60 days after sowing (DAS) (Table 1), preemergent application of oxyfluoren 0.12 kg ha^{-1} gave pod yields of 3206 kg ha^{-1} and application of fluchloralin 0.68 kg ha^{-1} gave 3287 kg ha^{-1}, comparable to one hand weeding at 25-30 DAS. Increase in the dosage of oxyfluorfen beyond 0.12 kg ha^{-1} did not increase the yield due to similar weed-control efficiency. The nonweeded control gave a significantly lower yield than the herbicide treatments owing to severe weed competition, particularly by grasses. This in turn lowered the individual plant productivity as revealed through fewer filled pods $plant^{-1}$ (26 as against 33 in fluchloralin) and double-seeded pods $plant^{-1}$ (20 as against 27-38 in fluchloralin and oxyfluorfen plots).

The cost of oxyfluorfen at 0.12 kg ha^{-1} compared well with that of fluchloralin at 0.68 kg ha^{-1}, whereas hand weeding and hoeing cost more due to higher labor requirement and wages. Herbicides proved cheaper besides providing good weed control and higher monetary returns (Rs 2481-2724 ha^{-1}) than weeding (Rs 1965 ha^{-1}). Added to this, the ratio of marginal returns (MR) to marginal cost (MC) was also higher in these treatments (10.8-11.4) than hand weeding (3.6).

Thus, the weeds, predominated by grasses, decreased the groundnut yield by 22-28%. Oxyfluorfen 0.12 kg ha^{-1} as a preemergent can be used as effectively as fluchloralin 0.68 kg ha^{-1} for weed control in irrigated groundnut under red sandy loam-soil conditions, besides being more remunerative than hand weeding and hoeing.

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Hollow-Heart Symptom in Groundnut Used to Survey for Boron Deficiency in Thailand

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Kernel development in groundnut is sensitive to boron deficiency, making the crop a good indicator of low boron status in soils. The boron deficiency symptom in groundnut kernels known as hollow heart (Fig. 1) has been previously used to evaluate the need for boron fertilization of groundnut crops (Morrill et al. 1977). In the present study, the incidence of hollow-heart disorder in farmers' groundnut crops was used to determine the extent and severity of boron deficiency in northern Thailand (Netsangtip et al. 1985).

A total of 88 sites were surveyed in the Chiang Mai valley and surrounding areas in the dry season of 1984/85 by collecting pods (30-200 pods sample^{-1}) from farmers' groundnut crops at harvest. Pods were collected directly from the farmer or indirectly through a district agricultural extension officer. Samples were assessed visually for the presence of the hollow-heart symptom and categorized as follows:

Nil	-	No hollow heart in sample
Mild	-	0.1-5.0% of kernels affected
Severe	-	5.1-20% of kernels affected
Very severe	-	>20% of kernels affected

The hollow-heart disorder was observed in groundnut kernels from half of the sites surveyed and was rated as severe at 32% of the sites. Almost all the upland sites (17 out of 20 sites) had hollow heart in kernel samples (Table 1). The most severe incidence of hollow heart affected 41% of kernels.

The widespread incidence of hollow-heart disorder in the Chiang Mai valley has been confirmed by the low levels of hot-water soluble boron in most soil series of this region (Hiranburana and Chawachati, in press).

Farmers' groundnut crops have now been surveyed widely in the northern region as well (295 sites) and hollow heart has been found at 28% of the sites (unpublished data).

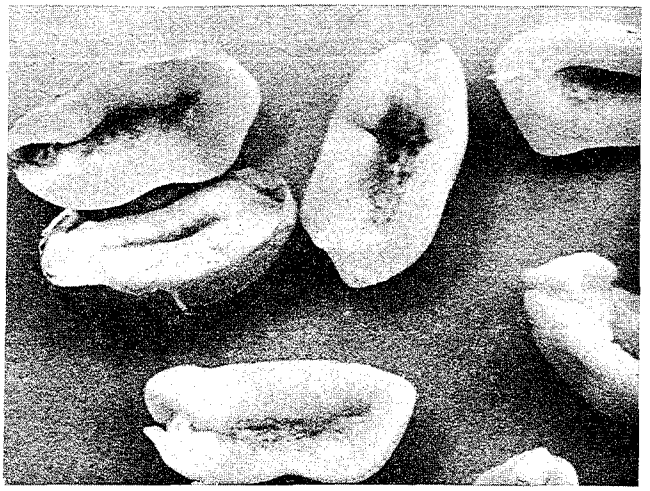

Figure 1. Hollow-heart symptoms in groundnut kernels. Note sunken, dark-colored lesions on the internal surface of cotyledon.

Table 1. Severity of hollow heart in kernels from farmers' groundnut crops on upland and lowland sites in the Chiang Mai valley, Thailand, dry season 1984/85. (Data from Netsangtip et al. 1985).

	Number of sites with hollow-heart kernels				
Type of site	Nil[1]	Mild	Severe	Very severe	Total sites
Lowland sites	41	11	13	3	68
Upland sites	3	5	10	2	20

1. See text for description of categories

This simple survey procedure is being used to identify boron deficiency elsewhere in Thailand and may have application in other groundnut-producing areas where the extent and severity of boron deficiency is to be determined.

This research was supported by the Australian Centre for International Agricultural Research, Canberra.

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Survey of Groundnut Diseases in Burkina Faso

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A disease survey was undertaken in the 3rd week of September 1987 to assess the relative importance of various groundnut (*Arachis hypogaea*) diseases and other production constraints in major groundnut-production areas of Burkina Faso. The survey was jointly sponsored by ICRISAT, Institut de recherches pour les huiles et oléagineaux (IRHO), Peanut CRSP (USAID), and the University of Ouagadougou. Sixty-four fields were examined in the eastern, central, south-central, and southern provinces of the country. Groundnut is cultivated almost entirely in small holdings with low crop-production inputs. In a majority of fields examined, the crop was at the pod-filling stage. In the eastern, central, and south-central provinces, groundnut is grown as a sole crop on the flat with a spacing varying from 40 cm to 50 cm between rows and 10 cm to 20 cm within rows. Spanish types are predominant in these areas. In the southern provinces, groundnut is found either as a sole crop or intercropped with sorghum on ridges with a spacing of approximately 1 m between rows and 20 cm within rows. Virginia bunch types are predominant in the southern provinces.

Early leaf spot (*Cercospora arachidicola*) was severe in nearly all fields examined in eastern, central, and south-central provinces. Extensive defoliation was observed in many fields and will probably result in significant losses in pod and haulm yields. All groundnut cultivars that are currently used by farmers in Burkina Faso are susceptible to this disease. Late leaf spot (*Phaeoisariopsis personata*) and rust (*Puccinia arachidis*) were most serious in the southern provinces, especially on spanish types. Rust was severe on RMP 12, a long-cycle virginia bunch type with resistance to groundnut rosette and moderate resistance to late leaf spot. Pod rot (possibly *Rhizoctonia solani*) was commonly observed in most of the fields but disease incidence was very low. Gray spots with zonate rings (causal agent unknown) and Phyllosticta leaf spot (*Phyllosticta arachidis*) were commonly observed on leaves in almost all fields.

A high incidence of peanut clump virus disease was observed in two fields in the southern provinces. Although groundnut rosette virus disease (both chlorotic and green) was serious in 1986, but its incidence was very low during the 1987 crop season. Severely stunted chlorotic plants were present in patches in two locations of the southern provinces and it is suspected that parasitic nematodes may be a contributing factor. Other diseases observed during the survey included collar rot (*Aspergillus niger*), aflaroot (*A. flavus*), leaf scorch (*Leptosphaerulina crassiasca*), witches' broom, spotted wilt, and peanut mottle. *Alectra* sp (family: *Scrophulariaceae*), a root parasite, was observed on groundnut in southern Burkina Faso.

Several of the rust and late leaf spot resistant germplasm and breeding lines received from ICRISAT Center, India, and the pod rot and nematode resistant lines from the Peanut CRSP of Texas A&M University, USA, are performing well in many locations in Burkina Faso. It is important to combine these resistances with rosette resistance bred in the IRHO and Institut national d'études et de recherches agricoles (INERA) programs in Burkina Faso to achieve yield stability.

Attagenus fasciatus (Thunberg) [Coleoptera: Dermestidae]-- A New Pest of Stored Groundnuts

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The members of the genus *Attagenus*, commonly called black carpet beetles, are generally considered to be scavengers feeding on organic matter of plant and animal origin, especially fabrics and carpets (Munro 1966). However, these beetles are found in groundnut stores, but have never been reported to cause much damage to groundnuts.

In warehouses, the larvae make their way through gunny bags or sometimes bore into packed-food containers and thus provide an opening for infestation by other storage pests. Therefore, it may be responsible for much more damage to stored products than usually credited with (Redlinger and Davis 1982). *Attagenus fasciatus* (Thnb.) has been intercepted in

USSR in cargoes of leguminous seeds exported from India (Bel'Skaya and Popava 1978). At ICRISAT Center, we found the beetles on gunny bags in which groundnuts were stored and on groundnut pods and seed stocks in long-term storage godowns. On close examination, the nature of damage caused by this species, both to kernel and pods, was quite evident (Fig. 1).

Life history. The adult is a small ovoid beetle, 4.3-mm long and 2.4-mm wide; the head and thorax are black, with a prominent whitish horizontal band on the elytra. The eggs are whitish, translucent, and 0.5-mm long. The larvae are easily recognized by their elongated hairy and conical body with head located at the broader end. The young larvae are brown, and blacken as they grow. Full-grown larvae are about 7.7-mm long and 1.2-mm wide. The larval body is covered with short hairs and provided with a tuft of long hairs at the end of the abdomen (Fig. 1). The studies conducted at 25(+1)°C constant laboratory temperature with 75+10% relative humidity revealed that eggs required 7 days to complete their growth, larvae required 399 days, and pupae required 17 days. This data related to the mean developmental period of 239 eggs, 5 larvae, and 5 pupae that reached adulthood.

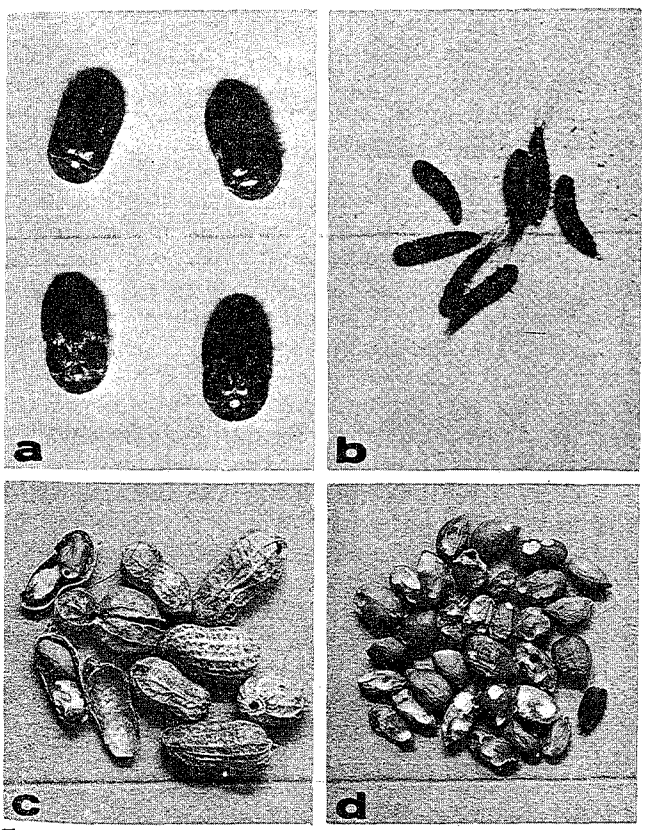

Figure 1. (a) Adult black carpet beetles *Attagenus fasciatus* (Thunberg); (b) larvae of *A. fasciatus* ; (c) groundnut pods damaged by *A. fasciatus* ; and (d) groundnut kernels damaged by *A. fasciatus*.

Damage. To assess the damage potential of the species, 50 young larvae were released in a cylindrical plastic container (15-cm height and 11-cm diameter) containing 100 uninfested kernels. The same number of larvae were released on 100 healthy pods in a similar container (only 2 larvae from kernels and 3 larvae from pods reached adulthood). The plastic containers with neonate larvae were kept at 25(+1)°C constant temperature in an incubator. Of the kernels, 60% had been damaged by the end of the larval stage. This resulted in a considerable, but unquantified reduction in quality and a 4.3% reduction in mass. A 16% infestation of pods resulted in a 5.1% reduction in pod mass. The young larvae bored into the pods through a minute hole and fed on the kernel, staying inside the pod during their development period. Sometimes two or three larvae were feeding in a single pod. Full-grown larvae emerged from the pods to pupate outside. The long life cycle of this species will limit the potential of this insect to become more than a minor pest of stored groundnuts but it may be of importance in stores where produce is kept for long periods. This species is also considered of quarantine significance since it can be transported through stored agricultural products and seed materials from one country to another.

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Two New Hymenopterous Egg Parasites of *Nezara viridula* Linn. (Pentatomidae: Hemiptera)

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The use of biological-control agents, egg parasitoids in particular, has recently gained attention and

popularity. The green stink bug or green soldier bug, *Nezara viridula* Linn. is considered by several workers as a major pest, particularly of soybeans (*Glycine max*) and mungbean (*Vigna radiata*) in the Philippines. Lately, *N. viridula* was found to infest and feed on groundnut. This triggered a field survey and collection of egg parasitoids of *N. viridula.*

Two new hymenopterous egg parasites, *Telenomus comperei* Crawford and *T. pacificus* (Gahan), both belonging to family *Scelionidae*, were obtained from *N. viridula* eggs in a groundnut agroecosystem. The female of *T. comperei* is black and about 0.90-mm long. The antennal scape and pedicel and the legs are yellowish. The coxae and the antennal flagellum are black and dark brown respectively. *T. pacificus* females are black and measure about 0.92-mm long. The scape of antenna and the legs including the coxae are yellowish with the forecoxae, usually darker.

Both *T. comperei* and *T. pacificus* are capable of 100% parasitization after 24 h of exposure to the host eggs. The adults were observed to live up to 32 days when fed with pure honey. Otherwise, the adult life-span lasts for 2-3 days under laboratory conditions. The total development period of *T. comperei* reared on *N. viridula* eggs ranges from 12 to 14 days.

A Twin Spinning-Disc, Knapsack Sprayer for Groundnut

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(ICRISAT)

Several insect pests and diseases substantially reduce the yield of groundnut. Effective control of some of those can be achieved by correct application of pesticides. Application with conventional spraying techniques requires large amounts of spray solution. This requirement puts considerable hardship on farmers who have to fetch clean water from a long distance. Hand-held, battery-operated, spinning-disc, controlled droplet applicators (CDA) have been used successfully to apply several standard wettable powder and emulsifiable concentrate formulations diluted in water, on many crops. They are lightweight and require a very little quantity of water and hence offer great convenience in pesticide application.

We have developed a twin spinning-disc, knapsack sprayer (Fig. 1) for groundnut and other low-growing crops, such as chickpea and green gram. It combines the best features of the conventional knapsack sprayer and the hand-held spinning disc CDA. It consists of a 10 L chemical tank fitted on a tubular frame. The 1.5-m wide boom is an integral part of the frame. Two spinning-disc applicators mounted on the boom are energized by a 6 V rechargeable battery, placed under the chemical tank. The chemical solution flows from tank to the spinning

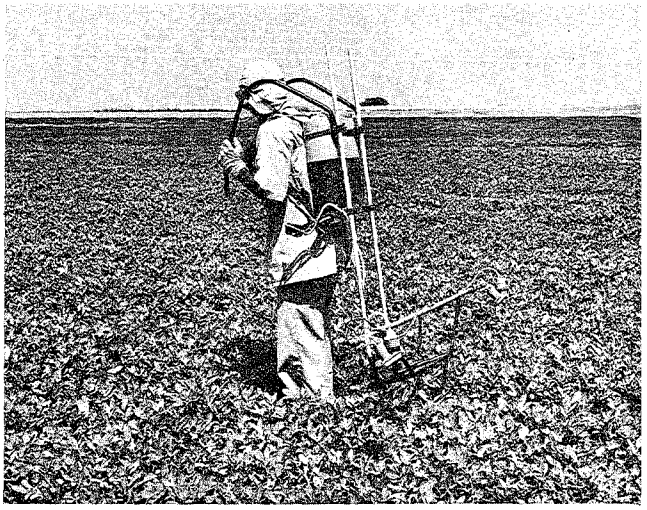

Figure 1. A twin spinning-disc, knapsack sprayer for groundnut and other low-growing crops.

discs through a cutoff valve and a flow-regulating disc. The constant feed of spray solution is obtained by an air-bleed, capilliary tube through the container cap. The sprayer is carried on the back of the operator and the position of the boom can be adjusted to obtain the correct height of the boom above the crop. The dry mass of the sprayer is approximately 9 kg and its cost is about Rs 900 (US$ 70).

In spraying tests conducted on groundnut and chickpea crops, this sprayer performed satisfactorily and controlled *Aproaerema modicella* (leaf miner) and *Heliothis armigera* adequately. It covers a 3-m wide swath, and requires only 15 L of water and about 1.5 h for spraying 1 ha.

Low-volume spraying can be hazardous, for the spray mix is very concentrated. However, since the spray boom is behind the operator, he always walks ahead of the spray. The contamination risk can be further minimized if a polythene sheet is suspended from the sprayer frame or is worn as an apron to protect the legs of the operator. In addition, the operator must wear protective clothing, including a face mask, and gloves must be used when the pesticide is being mixed and filled into the tank. Spraying should only be done when there is little or no wind, and the operator should walk so that the wind is always at least 30° across his path. Very toxic chemicals must not be used in such sprayers and the operator must be adequately trained in safety precautions.

Further details of the design of this sprayer are available from the authors.

Recent ICRISAT Publications

The publishing address for each item is: ICRISAT, Patancheru, Andhra Pradesh 502 324, India.

ICRISAT. 1987. Groundnut. Pages 213-258 *in* ICRISAT Annual Report 1986. For offprints, write to Legumes Program, ICRISAT.

ICRISAT. 1987. Publications Catalog. This catalog gives a listing of ICRISAT publications such as annual progress reports, general audience publications, research and development leaflets, audiovisual materials, books, bibliographies, research bulletins, information bulletins, workshop and symposia proceedings, newsletters, plant materials descriptions, and genetic resources collection reports. Copies of the catalog are available free from ICRISAT Information Services at the above address.

ICRISAT. 1987. ICRISAT in Print: a cumulative record of publications 1975-86. This catalog consists of 1450 entries categorized by crop and discipline, indexed by author. It has been compiled from the records of the Editorial Committee and comprises journal articles, conference papers, institute-level publications, and theses resulting from work done at ICRISAT.

Book Review

J.A. Wightman (ICRISAT)

Dick, K.M. 1987. **Pest Management in Stored Groundnuts.** Information Bulletin 22. Patancheru, A.P. 502 324, India: ICRISAT. ISBN 92-9066-124-0.

Groundnuts can be colonized by insects at any time from harvesting to processing and consumption. The 28-page Information Bulletin by K.M. Dick describes the eight insect species most likely to be encountered in stored groundnuts by farmers and warehousemen in developed and developing countries. The adult and immature stages are illustrated with black and white photographs and line drawings. Descriptions of damage symptoms are clear and are depicted in color plates of excellent quality. The bulletin contains details of methods to detect low-density pest populations before they build up to damaging levels. The addresses of commercial suppliers of special traps are included.

Once an infestation has occurred it is often necessary to assess the extent of the damage that has taken place. The method employed depends on the mode of storage--sacks or bulk--and the quantity. The techniques for all situations are illustrated, stress being on the use of correct sampling to collect unbiased samples. Dr Dick has included a flow-chart of the procedure he used to monitor a bruchid infestation in a warehouse in India.

Infestations are better prevented than cured. The importance of putting only properly dried pods into storage, and using disinfected, insect-proof stores is stressed. The appropriate rates of the most suitable insecticides are given. The need for simple hygiene is stressed. Techniques for disinfestation are also included.

Nonchemical methods are included under the heading 'integrated pest management'. There is an obvious need for research in this area. Apparently, some new groundnut varieties are more susceptible to attack by storage pests than the indigenous lines they are supposed to replace.

This is a concise, clearly written document that contains information that is relevant to the needs of scientists, extension workers, farmers, and warehouse managers in the developing and the developed world.

The bulletin can be obtained from: Information Services, ICRISAT, Patancheru, Andhra Pradesh 502 324, India. The costs are: less-developed countries US$ 2.80+postage; highly developed countries US$ 8.40+postage (Airmail US$ 3.60; surface mail US$ 1.80). Cost in India Rs 35.00; postage Rs 7.00.

New Abstract Service

The International Development Research Centre (IDRC), Canada is funding a project called SATCRIS (Semi-Arid Tropical Crops Information Service), which succeeds the SMIC (Sorghum and Millets Information Center) project. The SATCRIS project envisages the provision of information retrieval and dissemination services on all five crops mandated to ICRISAT, to scientists all over the semi-arid tropics (SAT).

SATCRIS will collaborate with the CAB International, a leading provider of agricultural information, in disseminating current information to ICRISAT scientists, and scientists in the various national, regional, and international programs working on the five crops mandated to ICRISAT all over the SAT. CAB International will produce three specialist abstracts journals: (i) Sorghum and Millets Abstracts, (ii) Chickpea and Pigeonpea Abstracts, and (iii) Groundnut Abstracts. These abstract services will be distributed free of cost by CAB International, mostly to national and other organizations and to some individuals in the SAT identified by ICRISAT.

The abstracts service on Sorghum and Millets started in 1987, while the services on chickpea and pigeonpea, and groundnut will commence in 1988.

Organizations interested in the new abstracts service may get in touch with SATCRIS, Library and Documentation Services Division, ICRISAT.

As this new abstract service will soon be available to you, we have discontinued the abstract section of the newsletters.

Invitation to Join AGLN

If you are working on the improvement of groundnut in Asia and are interested in receiving information about literature, breeding and germplasm material, and training that is available at ICRISAT, you are invited to become a cooperator in the Asian Grain Legumes Network (AGLN). Application forms are available from:

The Coordinator
Asian Grain Legumes Network
International Crops Research Institute
for the Semi-Arid Tropics (ICRISAT)
Patancheru
Andhra Pradesh 502 324, India

Application for Inclusion in the Mailing List

If you wish to be included in the mailing list of INTERNATIONAL ARACHIS NEWSLETTER, and have not received a copy of the second issue, and have not returned an application form, please send the following information *in full* to:

The Editor
INTERNATIONAL ARACHIS NEWSLETTER
Legumes Program
ICRISAT, Patancheru
Andhra Pradesh 502 324
INDIA

Include correct designation, as in most cases copies will be mailed by designation and not by name. Please type or print clearly in block letters.

Title (Dr Prof Mr Mrs Miss Ms),

Surname,

Given name(s),

Designation,

Institute/Organization,

Street Address,

City,

State/Province,

Postal/Zip Code,

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Telex No.,

Telephone No. (Off), Telephone No. (Res),

Cable Address,

If you are a member of a Computer Based Messaging System or Electronic Mail System please give your CBMS address,

Nationality,

First language,

Please indicate your areas of interest:

Breeding	Cytogenetics	Physiology	Pathology	Microbiology
Training	Extension	Entomology	Others.....	

If you have visited ICRISAT, give dates of visit, and names of persons(s) visited.

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