Reports

Disease Constraints to Groundnut Production in Vietnam–Research and Management Strategies

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Groundnut is the most important food legume crop in Vietnam, and is cultivated over 200 000 ha annually. It is an important cash crop, and a vital export commodity. The major groundnut-growing areas of Vietnam are Nghe An (20 000 ha), Ha Tinh (10 000 ha), Thanh Hoa (15 000 ha), and Ha Bac (10 000 ha) provinces in northern Vietnam, and Tay Ninh (20 000 ha), Song Be (15 000 ha), Long An (10 000 ha), and Dong Nai (10 000 ha) provinces in southern Vietnam. The average pod yield is about 1.0 t ha^{-1}.

Until recently, very little attention was paid to research on disease problems in groundnut. During 1990–1992, systematic surveys were conducted to assess the disease constraints in the major groundnut-growing areas, and to determine research priorities and disease-management strategies.

Disease Problems

Foliar diseases. Rust (*Puccinia arachidis* Speg.) and late leaf spot [*Phaeoisariopsis personata* (Berk. & M.A. Curtis) van Arx] are major fungal foliar diseases in all the groundnut-producing areas. They cause severe damage to the crop regularly in southern Vietnam. In northern Vietnam also, they cause severe problems to maturing crops. The overlapping of the groundnut cropping seasons in southern Vietnam favors the perpetuation of the rust and late leaf spot pathogens and thus contributes to the severity of the diseases. Occurring together, these diseases can cause 30–70% loss in pod yield and reduction in the quality of kernels. The relative importance of each disease varies from place to place and from season to season, depending upon the cropping systems and environmental conditions. Early leaf spot (*Cercospora arachidicola* Hori) can cause economic damage in some parts of northern Vietnam (Ha Bac, Vinh Phu, and Bac Thai provinces) in years when there are frequent early-season rains. This disease alone can cause 35–50% defoliation at peak flowering stage, and yield losses may reach 20–25%.

Other foliar diseases that affect groundnut are pepper leaf spot and leaf scorch caused by *Leptosphaerulina crassiasca* (Sechet) Jackson & Bell, phyllosticta leaf spot (*Phyllosticta arachidis-hypogaea* Vasant Rao), alternaria leaf spot (*Alternaria* spp), leaf blight (*Rhizoctonia solani* Kuhn), and botrytis blight (*Botrytis cinerea* Pers. ex Fries), but these diseases are of low incidence, and are not at present considered to be economically important.

Soilborne diseases. Damping-off and seedling diseases are of common occurrence in many areas in both northern and southern Vietnam and are collectively responsible for the considerably poor plant stands and low yields. Several fungi are involved in seedling diseases but the pathogens most commonly implicated are *Aspergillus niger* van Tieghem, *Sclerotium rolfsii* Saccardo, *Rhizoctonia solani*, *Macrophomina phaseolina* (Tassi) Goidanich, *Pythium* spp, and *Fusarium* spp. *Aspergillus niger* is the most important of these pathogens. Collar rot caused by this fungus is responsible for substantial seedling mortality (15–40%) in Nghe An, Thanh Hoa, and Tay Ninh provinces, particularly in sandy soils. The disease is most severe when there is drought stress early in the season.

Aflaroot disease incited by *Aspergillus flavus* Link ex Fries is of low incidence. Until recently, this disease was locally called 'stunt disease' which was thought to be caused by a virus.

Pod rots. Pod rots are also major constraints to groundnut production in many areas of northern Vietnam. *Pythium* spp, *Fusarium* spp, and *S. rolfsii* appear to be involved in pod rots. The affected pods develop brownish-black to black, water-soaked lesions. Pod rots become severe under waterlogging conditions due to heavy late-season rains. High temperatures and humidity, and excessive vegetative growth favor infection by *S. rolfsii*, which causes stem and pod rots. These pathogens also reduce the quality of groundnuts. Frequent rains towards crop maturity and poor drainage conditions enhance the severity of the problem. This problem is of common occurrence in Thanh Hoa and Nghe An provinces.

Bacterial wilt. Bacterial wilt, caused by *Pseudomonas solanacearum* (Smith) Smith, is becoming increasingly important in both northern and southern Vietnam. The disease is now recognized to be serious in Nghe An, Thanh Hoa, Long An, and Tay Ninh provinces where plant mortality can be 15–45%. But disease incidence varies from place to place. It is severe in the upland areas, particularly in sandy soils. Many of the local groundnut varieties are susceptible to bacterial wilt. The

disease incidence is highest at peak flowering and podding stages, although it can also be seen early in the season. Bacterial wilt is considered to be a major threat to groundnut production.

Collar rot and bacterial wilt often occur together in many areas, and cause considerable yield losses. Until 1991, both diseases were locally referred to as 'groundnut wilt' (Mehan et al. 1991).

Other diseases. A new foliar disease characterized by grayish-brown 'eye spots' (caused by a bacterium?) has been found to be serious in some areas of Nghe An province. It causes severe defoliation at flowering stage, especially when there are frequent early-season rains. The popular local groundnut variety Sen Nghe An is susceptible to this disease. Some exotic varieties (e.g., Vienpan and CES 102) were also found to be highly susceptible to it.

Peanut stripe and bud necrosis virus diseases are occasionally found but are low in incidence.

The distribution and severity of major foliar and soilborne diseases of groundnut in Vietnam are shown in Figures 1 and 2.

Research on Major Diseases of Groundnut

Foliar diseases. Research on foliar fungal diseases in Vietnam has concentrated on host-plant resistance. This research has been conducted at the National Institute of Agricultural Sciences (INSA), Hanoi. All local groundnut varieties are susceptible to rust, late leaf spot, and early leaf spot. During 1990–93, 540 germplasm and breeding lines (obtained from ICRISAT) were screened for resistance to rust and late leaf spot, using the infector-row technique. Fourteen genotypes were found to be resistant to rust, 19 to late leaf spot, and 6 to both. The most resistant genotypes include ICG 4747 (PI 259747), ICG 7884 (PI 341879), ICGV 87302, and ICGV 87305. They consistently showed scores of 2.0–3.5 on a 9-point disease rating scale. The local cultivar Sen Lai showed an average score of 6.5 for rust and 7.5 for late leaf spot. Most of the resistant genotypes are of long duration (150–155 days), have small seeds, and an undesirable testa color. These genotypes are now being used in breeding programs.

Chemical control of foliar diseases has been found to be effective in Vietnam. The fungicides chlorothalonil (Daconil®) and Anvil® have proved most effective in controlling both rust and leaf spots. One or two sprays of either of these fungicides can substantially control the diseases, and have been found to help in increasing pod yield by up to 25%. It may be possible to achieve effective and profitable control of these diseases with one chemical spray at 70 days after sowing (DAS) in early-sown crops in northern Vietnam. Late-sown crops may require two sprays (at around 55 and 70 DAS).

Bacterial wilt. Research on bacterial wilt is conducted mainly by INSA and the Plant Protection Research Institute (PPRI), Hanoi.

Most isolates of the wilt pathogen collected from several disease hot spots in Nghe An, Ha Bac, and Thanh Hoa provinces were found to be highly pathogenic to groundnut at 30–32°C. Several of them were also virulent to tomato, potato, and eggplant, but less virulent to tobacco. All the isolates tested showed good growth on sucrose peptone agar at 30–35°C. Research is now in progress to collect isolates of the wilt pathogen from various cropping systems involving groundnut in different agroecological regions, and to determine which biovars are prevalent, their virulence, and host ranges. Preliminary results indicate that all the collected bacterial isolates belong to race 1.

Several hot spots of this disease have been identified in Ha Bac, Thanh Hoa, and Long An provinces. A hot spot in Ha Bac is now being developed into a wilt sick plot for screening genotypes for wilt resistance. The procedure for developing a sick plot includes continuous growing of a highly susceptible cultivar in the same field season after season, incorporating wilted plants collected from various areas, and using artificially inoculated seeds for sowing. Late sowing is also practised to enhance disease incidence and severity, particularly in spring.

Twenty groundnut genotypes reported to be resistant to bacterial wilt in southeast and east Asian countries have been evaluated for resistance in northern Vietnam. Most of these genotypes (including Indonesian cultivars Gajah, Kidang, and Matjam) have shown resistance to bacterial wilt in Ha Bac and Nghe An provinces. Some accessions of Schwarz 21 (ICG 1609 and ICG 7968) have consistently shown high levels of resistance in disease hot spots, and under artificial inoculation conditions in the greenhouse at INSA. Several rust- and late leaf spot-resistant germplasm lines (e.g., ICG 1703 and ICG 1705) have also shown resistance to wilt. Some breeding lines (ICGV 87165 and ICGV 88252) also possess resistance to wilt. These genotypes are now being tested at several disease hot spots in both northern and southern Vietnam to ascertain the stability of their resistance.

Collar rot. All local cultivars and most of the introduced lines tested have shown susceptibility to collar rot. Several seed protectant fungicides are now being tested to

Province

1. Bac Thai
2. Vinh Phu
3. Thu Do Ha Noi
4. Ha Bac
5. Hai Hung
6. Ha Son Binh
7. Ha Nam Ninh
8. Thanh Hoa
9. Nghe Tinh
10. Song Be
11. Dong Nai
12. Tay Ninh
13. Thanh Pho Ho Chi Minh
14. Long An

Disease	Incidence/severity		
	Low	Moderate	Severe
Rust	△	▲	▲
Late leaf spot	○	●	●
Early leaf spot	□	■	■

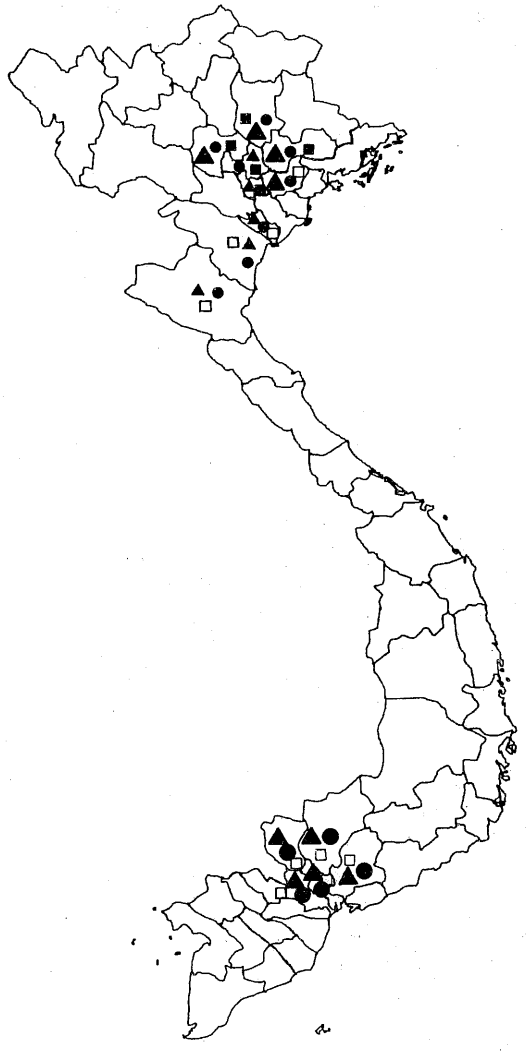

Figure 1. Distribution and severity of major fungal foliar diseases in Vietnam.

Disease	Incidence/severity		
	Low	Moderate	Severe
Bacterial wilt	△	▲	▲
Collar rot	○	●	●
Pod rot	□	■	■

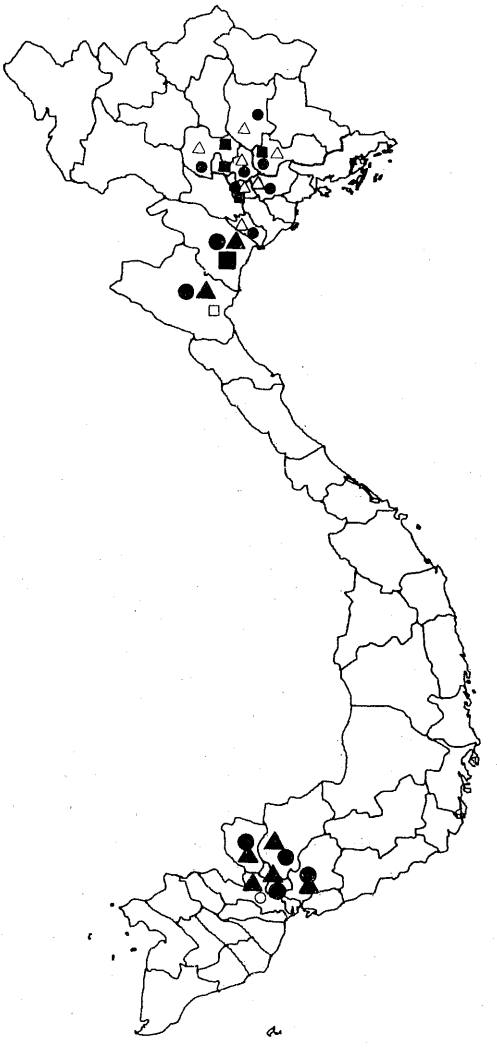

Figure 2. Distribution and severity of major soilborne diseases in Vietnam.

control collar rot and damping-off diseases at various locations in northern and southern Vietnam. Research on these diseases is conducted by INSA, and PPRI in northern Vietnam, and the Oil Plant Research Institute and the Institute for Agricultural Sciences in southern Vietnam.

Pod rots. No research has been conducted on pod rots, although this problem is becoming increasingly important.

Aflatoxin. Frequent rains and high temperatures and humidity at harvest time present drying problems, especially in northern Vietnam, and are likely to contribute to aflatoxin contamination in groundnuts. No systematic research has been done on this problem, but the limited research done at PPRI and INSA has recently shown that a large proportion of seeds were infected by *Aspergillus flavus* during storage (H. M. Trung, personal communication). A few groundnut oil cake samples tested in the late 1980s showed high levels of aflatoxin (Blaha et al. 1990).

Disease Management Strategies

- Developing genetic resistance to rust, late leaf spot, and bacterial wilt should be the thrust of the disease-management strategy.
- Incorporating combined resistance to bacterial wilt, rust, and late leaf spot into high-yielding cultivars adapted to specific environments should get a high priority because foliar diseases are severe in many areas where bacterial wilt is also a constraint to groundnut production.
- Integrated disease management is advocated; this should include use of disease-resistant cultivars, appropriate cultural practices, and crop rotation. Considering the fact that farmers in Vietnam are resource poor, it would be appropriate to use low-cost inputs while using limited need-based chemical control (for foliar diseases and for damping-off).

Future Research Priorities

- Research on bacterial wilt needs to be intensified. More systematic research should be undertaken to understand the influence of different cropping systems and crop-management practices on the incidence/severity of major diseases, particularly bacterial wilt and pod rots.
- Wilt sick plots need to be developed for effective screening for wilt resistance. It is imperative to evaluate new breeding lines that are being considered for release for their reaction to bacterial wilt.
- The possibility of seed transmission of bacterial wilt needs to be investigated. This is important for the safe movement of seed within the country, and for integrated disease management.
- Research on damping-off and collar rot diseases should be intensified, with emphases on the role of major pathogens implicated in the damping-off disease complex, and identification of effective seed protectants.
- Regular surveys are required to assess the importance of major diseases, and to confirm the occurrence of peanut stripe which is prevalent in several southeast and east Asian countries.
- Priority should be given to research on the aflatoxin problem as Vietnam attaches much importance to the export of groundnuts and their products.

References

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Mutation Breeding in China: Achievements and Prospects in Groundnut

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Mutation breeding in groundnut has been employed in China since the 1960s. This paper reports the major achievements of this effort since then.

New varieties developed through induced mutation. More than 20 new groundnut varieties have been bred