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INTERNATIONAL
FOUNDATION
FOR SCIENCE

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FOREWORD

By 1972, the year the International Foundation for Science was founded, scientists, academics, and policy makers interested in development aid had long recognized the difficult situation faced by young scientists from developing countries. Research opportunities did not exist in their countries, or if they did, they were reserved for senior and well-established researchers.

The need for an organization that could enable young scientists to pursue a career of research in their homelands was clear, and in 1972 Sweden and Canada provided the initial funds to establish such an organization, the IFS. Since then France, the Federal Republic of Germany, the Netherlands, Belgium, Norway, Switzerland, Nigeria, the United States, Australia and UNESCO have joined as donors of the Foundation. Member Organizations--scientific academies, research councils, and royal societies--from 65 countries advise the IFS on policy and promote its activities.

In the past ten years the IFS has awarded grants to nearly 800 scientists in 78 developing countries for research within a granting programme that includes Aquaculture, Animal Production, Food Crops, Afforestation and Mycorrhiza, Fermentation and Applied Microbiology, Natural Products, and Rural Technology. The grantees were selected based on the recommendations of the IFS Scientific Advisers, specialists in the IFS scientific areas who serve the IFS voluntarily and in a personal capacity.

The grants are modest (normally not more than USD 10 000) and can be awarded up to four times per grantee. Since the institute of the grantee provides a salary and facilities, IFS grants are devoted to purchasing the basic tools of research--equipment, expendable supplies, literature. Because grantees often face isolated and difficult conditions, because they are young and inexperienced, the IFS provides more than financial support.

Workshops are arranged on behalf of the grantees and are attended by IFS Scientific Advisers. These advisers provide guidance to grantees on such occasions, as well as by mail and visits to research sites.

The IFS was founded because there was no other organization providing this kind of support to developing countries. Today, ten years later, the IFS is still unique among organizations. This was the conclusion reached by a 1981-82 evaluation of the

FOREWORD

IFS commissioned by the IFS Sponsors and conducted by an external panel headed by Dr Francisco Sagasti of Peru and Prof Geoffrey Oldham of the United Kingdom. The panel also concluded that the IFS had succeeded in reaching the intended target group of young and well-educated scientists and had provided them with research opportunities in their own countries that would not otherwise have been available. The panel was satisfied with the selection of grantees and the quality and relevance of the research done by these scientists.

The panel made a number of recommendations for future activities. The proportion of grants given to scientists in Latin America and Africa should be increased in order to balance the geographic distribution between these continents and Asia. Because of the importance of the IFS Scientific Advisers to the success of the IFS activities, their number should be increased. The Foundation has implemented both of these recommendations.

The most important recommendation was that the IFS increase the scope of its activities. The need for such an increase is reflected by the number of applications received by the Foundation. Today the IFS is able to provide support for only one out of every three applicants. The IFS is making concerted efforts to seek additional funds that such a recommendation, and such a need, imply.

Gordon Butler
President

GUIDE TO IFS WORK

AFFORESTATION AND MYCORRHIZA

This report is a chapter of the IFS WORK, which includes chapters of all the scientific areas of the IFS granting programme: A, Aquaculture; B, Animal Production; C, Food Crops; D, Afforestation and Mycorrhiza; E, Fermentation and Applied Microbiology; F, Natural Products; G, Rural Technology. These other chapters have also been printed individually and are available from the IFS Secretariat.

AFFORESTATION AND MYCORRHIZA presents in numerical order the names and institutions of grantees who have received grants in this scientific area during the years 1974 - 1983. The title, a short summary, and subject descriptors (taken from the OECD MACROTHESAURUS; those not found in the OECD publication are preceded by asterisks ***) are included as well as the amount of funding provided by the IFS. These amounts are given in SEK, Swedish Crowns. The funding dates coincide with the year of the award. Completed projects are indicated by a date; when no such date appears, the project is active as of 1983.

A brief introduction of the scientific area was written by the IFS Scientific Secretary Mr Jacques Gaillard. There are two indexes: one by subject descriptor, the other by country.

The summaries of the projects were written at the IFS Secretariat and submitted to the grantees for their approval.

The information contained in the IFS WORK is part of a database created for sharing project information, the International Development Research Information System (IDRIS). The system, in the pilot project stage, is being hosted by the International Development Research Centre (IDRC) of Canada. The database is stored in the Centre's minicomputer, which uses MINISIS software. MINISIS processors were used to extract the information for the printing of the IFS WORK.

Ms Judith Furberg, Information Secretary, was responsible for the compilation and editing of the IFS WORK 1974 - 1983.

AFFORESTATION AND MYCORRHIZA

Mycorrhiza, or fungi in symbiotic association with plant roots, has a wide distribution in the plant kingdom. Since its discovery in the 1880s, intensive research has revealed its common occurrence in almost all families of vascular plants. Two main types have been described, ectomycorrhiza and endomycorrhiza.

In ectomycorrhiza, the fungal hyphae usually surround the short roots of the host plant with a compact sheath and grow through the root cortex forming a so-called Hartig net between the cortical cells without penetrating into the cells. Ectomycorrhiza is characteristic of many common forest trees of the temperate zone, i.e., the families Pinaceae (pines), Fagaceae (beech and oak), and Myrtaceae (eucalyptus). Because of the economic importance of these trees, particularly pines, there has been a great deal of research over several decades in the developed countries on ectomycorrhiza.

In endomycorrhiza, the fungal hyphae usually grow inside the cortical cells forming characteristic structures which are called vesicles and arbuscles (called vesicular-arbuscular mycorrhiza, or VAM). The existence of VAM enables certain plant species, i.e., sweet gum, vine, onions, to become more efficient users of soil phosphate. Other species, of particular importance to tropical countries, i.e., citrus, coffee, tea, cocoa, rubber, papaya and oil palm, also depend on VAM for phosphate uptake. Despite the importance of endomycorrhiza, little work in this area has so far been done. Only recently have scientists focused their attention on endomycorrhiza research.

Both ecto- and endomycorrhiza can also increase the phosphorus uptake by plants, especially in the phosphorus-deficient soils typical of the tropics. In view of the high cost of phosphate fertilizers, fertilization by proper application of mycorrhizal fungi could reduce dependence on phosphate fertilizers.

The occurrence of mycorrhiza is also of great importance for afforestation programs in the tropics. When attempts to introduce exotic pines failed it was often because suitable symbiotic fungi were not introduced with the host trees.

It was for the above reasons that the IFS, when starting its granting programme in 1974, selected mycorrhiza studies as one

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AFFORESTATION AND MYCORRHIZA

of importance for developing countries. The area was extended in 1976 to include general afforestation problems.

Fifty four scientists have been awarded grants from the IFS in the field of Afforestation and Mycorrhiza during the period 1974 to 1983. Asia accounts for more than half of the grantees, Africa for one third, and Latin America for the remainder. As a result of recent visits by members of the IFS Secretariat to Africa and Latin America, the Foundation is receiving more and more applications from scientists in these parts of the world.

Two thirds of the grantees are conducting research on mycorrhiza, and they are equally interested in ecto- and endomycorrhiza. This is a recent trend; until 1980 ectomycorrhiza research was dominant. Most work on ectomycorrhiza deals directly or indirectly with mycorrhizal inoculation of exotic pines in forest nurseries. Considering heightened efforts in developing countries to reforest barren or marginal land, this line of work is of great practical interest. Many grantees are especially interested in long fibre conifers. They are also working on selecting the best fungi for their country's particular environment. The aims are to introduce efficient strains without introducing pathogens at the same time, to develop practical inoculation techniques, and to improve general nursery techniques.

Most of the projects on endomycorrhiza are studies of the vesicular-arbuscular mycorrhiza (VAM) association with agricultural crops and tropical trees. These crops and trees include: wheat, tomatoes, eggplants, mungbeans, cowpeas, winged beans, cassava, cotton, oil palms, cocoa and rubber. The introduction of better adapted and more efficient endomycorrhizal fungi into agricultural practices appears to be possible both in experimental plots and under field conditions and may form the basis of one application of VAM research.

Studies on the combined effects of VAM and other soil microorganisms with phosphate solubilizing bacteria and nitrogen-fixing bacteria are also carried out. The effect of mycorrhizal fungi on soil aggregation is also being studied by grantees with particular attention to the ability of the fungi to stabilize or control erosion of sandy soils.

About 10% are working on agroforestry projects. They are studying various systems of land management in which trees are

AFFORESTATION AND MYCORRHIZA

grown together with agricultural crops to optimize and sustain crop yields and ecological stability. In establishing these systems, both crops and trees should be compatible and complementary. Research is most needed to improve marginal and degraded ecosystems.

The remaining grantees are conducting forestry research, including investigation of rain forest ecology, genetic improvement of fast-growing tree species, improved propagation techniques, reforestation in dry zones and regeneration of tropical forests after clearing and mining operations. Most are located in Africa.

A major event for grantees was the organization of the International Workshop on Tropical Mycorrhiza Research in Kumasi, Ghana, in 1978. The workshop reported and consolidated the recent knowledge of mycorrhiza research in the tropics and gave prospects for the practical use of mycorrhiza and its role in the tropics. Based on the papers presented by IFS grantees and scientific advisers, a book entitled "Tropical Mycorrhiza," edited by Professor P Mikola, was published in 1980 by the Oxford University Press.

Because the number of scientists conducting mycorrhiza research in the tropics is very limited, those that are qualified should be given the training necessary to successfully complete their research. The organization of regional training courses on mycorrhiza research techniques has therefore been proposed. The first was held in 1982 in collaboration with the Universiti Pertanian Malaysia (UPM) and with support from UNESCO. A second is planned to be held in Costa Rica in 1985.

AFFORESTATION AND MYCORRHIZA

Grantee D011: Dr Albert Ofosu-Asiedu, Forest Products Research Institute, The Council for Scientific and Industrial Research, (CSIR), P O Box 63, KUMASI, Ghana

"Pine mycorrhiza in Ghana's afforestation programme"

IFS funding: 22500 SEK 1974 35200 SEK 1975

Dr Ofosu-Asiedu will study the most suitable and economic procedures for field inoculation of pines with mycorrhizal fungi, the mass production of suitable fungi, as well as the performance of the inoculated pines. The natural occurrence of pine mycorrhizal fungi in Ghana will also be investigated, as well as the efficiency, adaptation, and the rate survival in Ghanaian soils.

/afforestation/ /fungi/

*** /ectomycorrhizae/ /pinus/ /inoculation/

Grantee D012: Dr Zacchaeus Momoh, Forestry Division, Nigerian Paper Mill Ltd, P M B 581, JEBBA, Kwara State, Nigeria

"Mycorrhiza association in tropical pines"

IFS funding: 16200 SEK 1974 38315 SEK 1975
Completed 1977

The project will involve the identification of existing mycorrhizal fungi in plantations, a study of their biology and their effect on the trees. It will also include research for exotic and indigenous fungi capable of suitable associations with pines in Nigeria and able to withstand the high temperatures and long dry seasons in Northern Nigeria.

/afforestation/ /fungi/

*** /ectomycorrhizae/ /pinus/ /inoculation/

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AFFORESTATION AND MYCORRHIZA

Grantee D037: Prof S Kondas, Tamil Nadu Forest Plantation Corporation Ltd., 4 Promenade Road, Cantonment, TIRUCHIRAPALLI 620 001, India

"Mycorrhizal associations in tropical pines in Nilgiri Hills"

IFS funding: 8900 SEK 1974 Completed 1979

The project is aimed at the screening of naturally occurring mycorrhizal fungi in association with pines in Nilgiri Hills and other forests of Tamil Nadu. With the development of paper and pulp industries, there is a great demand for the introduction of exotic pine species on a large scale. Prof Kondas will collect samples of mycorrhiza and fungi from older pine plantations in the area and study the effect of pure inoculation of different strains.

/afforestation/ /fungi/

*** /ectomycorrhizae/ /pinus/ /inoculation/

Grantee D038: Dr Margaret Mmbaga, Department of Botany, University of Dar Es Salaam, P O Box 350600, DAR ES SALAAM, United Republic of Tanzania

"Mycorrhizal infections in rice"

IFS funding: 21000 SEK 1974 Completed 1976

Dr Mmbaga has prepared a study of the occurrence of mycorrhizal infections in rice and the differences between paddy rice and upland rice.

/rice/

*** /endomycorrhizae/

AFFORESTATION AND MYCORRHIZA

Grantee D039: Dr Maria Valdes, Departamento de Microbiología,
Escuela Nacional de Ciencias Biológicas, Apartado
Postal 4-870, MEXICO 4, DF, Mexico

"Mycorrhizal inoculation and the afforestation of the deep
valley of Mexico City"

IFS funding: 23600 SEK 1974 22880 SEK 1976
 52020 SEK 1981

The optimal symbiotic relationship between the following fungi
and pine species will be investigated: Laccaria laccata,
Pisolithus tinctorius, Boletus sp. and Lepiota sp.; Pinus rudis,
P. montezumae, douglaciana, lawsoni, michoacana, pseudostrobus,
radiata, avacahuite and teocote.

/afforestation/ /fungi/

*** /ectomycorrhizae/ /pinus/ /inoculation/

Grantee D138: Dr C V S Gunatilleke, Department of Botany,
University of Peradeniya, PERADENIYA, Sri Lanka

"Ecological investigations of the Sinharaja tropical rain forest
in the lowland wet zone of Sri Lanka"

IFS funding: 33000 SEK 1976 10810 SEK 1978

The destruction of forests has been severe in Sri Lanka, and
endemic tree species are threatened with extinction.
Dr Gunatilleke intends to investigate the ecology--the
structure, floristic composition and spatial variation of the
vegetation--of the Sinharaja Forest in the lowland wet zone.
Data about endemic tree species will be collected, and optimum
composition and the size of the forest will be investigated to
ensure the conservation of the threatened species.

/ecology/ /forest conservation/

*** /tropical rain forests/

AFFORESTATION AND MYCORRHIZA

Grantee D171: Dr Nahid Saleh-Rastin, Faculty of Agriculture,
University of Tehran, KARAJ, Iran

"Study of the ectomycorrhiza of forest trees in Iran"

IFS funding: 26100 SEK 1976 34400 SEK 1979

Dr Saleh-Rastin intends to make a survey of mycorrhizal forest trees and investigate the morphological characteristics of their fungus-root system. She will then isolate the fungi symbionts in pure culture, identify the species and study their ecological distribution and the effect of habitat on the intensity of infection. Assessment of some physiological properties of the fungi concerned, especially as to their resistance to salinity and drought, will be carried out. Dr Saleh-Rastin intends to continue her work by investigating the problems of afforestation and use of inoculation methods in Iran.

/forest trees/ /afforestation/

*** /ectomycorrhizae/ /pinus/ /inoculation/ /saline soils/

Grantee D172: Dr Ponciano Halos, Department of Plant Pathology,
University of the Philippines at Los Banos,
(UPLB), College, LAGUNA 3720, Philippines

"Use of mycorrhiza to increase agricultural crop productivity"

IFS funding: 17400 SEK 1976 17400 SEK 1980

Dr Halos will survey the occurrence and distribution of mycorrhiza in roots of solanaceous vegetables, rice, corn, sugar cane, tobacco, and possibly pasture grasses. The associated mycorrhizal fungi and the type of mycorrhiza will be identified and promising strains will be selected by bioassay with crop plants. The nutritional and environmental factors that enhance fungal inoculation, establishment and spore production on roots will be investigated to increase crop productivity under normal field conditions. The ultimate aim will be to facilitate the establishment of plants in various areas of the Philippines with adverse soil and climatic conditions through utilization of the improved and properly nourished strains of mycorrhizal fungi.

/food crops/ /fungi/

*** /endomycorrhizae/ /inoculation/

AFFORESTATION AND MYCORRHIZA

Grantee D173: Mr Abdul Manap Ahmad, Faculty of Forestry,
Universiti Pertanian Malaysia, (UPM), SERDANG,
Selangor, Malaysia

"Survey of rhizobial and mycorrhizal association of Malaysian forest trees"

IFS funding: 34800 SEK 1976 40000 SEK 1981

Leguminous trees are important timber trees in Malaysia. Little work has been done on the symbiotic association between leguminous trees and nitrogen-fixing bacteria. The researcher aims at investigating the possibilities of a double symbiotic association: rhizobia-mycorrhiza-tree. Rhizobia from leguminous trees will be isolated and identified by various techniques, such as nutritional and serological tests, host association and cross inoculation. It is expected that most of the tree species will have nodules on their roots. Mycorrhiza from important tree species will be isolated and identified and its type of association will be determined. Strains of rhizobium and mycorrhiza will be reinoculated and their effect on the host tree will be evaluated.

/leguminosae/ /forest trees/ /fungi/ /nitrogen fixation/

*** /ectomycorrhizae/ /endomycorrhizae/ /rhizobium/
/inoculation/

AFFORESTATION AND MYCORRHIZA

Grantee D174: Dr Baz Shirzad, Department of Horticulture and Forestry, Faculty of Agriculture, KABUL University, KABUL, Afghanistan .

"The effect of mycorrhiza on the growth and establishment of transplanted seedlings of different Afghan evergreens"

IFS funding: 28275 SEK 1976 13200 SEK 1981
Completed 1982

Dr Shirzad will study the effect of mycorrhiza on the performance of five evergreen forest species (Cedrus deodora and Pinus excelsa, P. gerardiana, P. polycarpus and P. longifolia) under a simulated afforestation system to determine which species has the closest symbiotic relationship with the fungi. Seeds and mycorrhiza samples will be collected in the three main areas of the natural forests of the country. Under semi-greenhouse conditions and in pots, evaluations will be made on the basis of percent seed germination, vegetative growth of tops and roots of seedling. Establishment of the transplanted seedlings as well as mineral absorption response of the five tree species to the mycorrhiza will be evaluated.

/forest trees/ /fungi/

*** /ectomycorrhizae/ /pinus/ /inoculation/

AFFORESTATION AND MYCORRHIZA

Grantee D215: Ms Martini Martoyo, Forest Research Institute,
P O Box 66, BOGOR, Indonesia

"Mycorrhiza in Pinus merkusii and its use in afforestation"

IFS funding: 17600 SEK 1977 13200 SEK 1979

Ms Martini will plant seeds from P. merkusii in sterilized sand medium, and after six months groups of seedlings will be planted in pots with both natural and sterilized soil. The growth of the seedlings will be compared periodically and followed by analysis of ash content at the end. Pure cultures will be grown from sporophores of known fungal species growing in pine forests. Their ability to form mycorrhiza will be tested under aseptic conditions and, if successful, used in afforestation efforts.

/afforestation/ /fungi/

*** /ectomycorrhizae/ /pinus/ /inoculation/

Grantee D216: Ms Pathmaranee Nadarajah, Department of Botany,
Universiti Malaya, Lembah Pantai, KUALA LUMPUR,
Malaysia

"Studies on the endomycorrhiza of oil palm (Elaeis guineensis)
and cocoa (Theobroma cacao)"

IFS funding: 20240 SEK 1977 19780 SEK 1979

Roots from oil palm (Elaeis guineensis) and cocoa (Theobroma cacao) are infected with vesicular-arbuscular mycorrhiza (VAM). Ms Nadarajah will study the VAM infection as a way of improving the P-nutrition of these crops. The effects of different types of inoculation of various strains of VAM will be studied. Effects of treatment with Endogone spores will be observed and subsequent growth studies will be made on plants subjected to different soils, pH, water regimes and nutrient supply (NPK).

/oil palms/ /fungi/

*** /endomycorrhizae/ /cocoa trees/ /inoculation/

AFFORESTATION AND MYCORRHIZA

Grantee D217: Mr Choob Khenmark, Department of Silviculture,
Faculty of Forestry, Kasetsart University,
BANGKOK 9, Thailand

"Mycorrhiza associations in Thailand's tropical pines and
dipterocarps"

IFS funding:	28160 SEK 1977	11000 SEK 1979
	11480 SEK 1981	

The objective of this investigation is mainly to map the distribution of mycorrhizal fungi in natural stands of Pinus merkusii, P. kesiva and dipterocarp species in North and Northeast Thailand. Since a seasonal variation of mycorrhizal fungi occurrence is expected, sample collection will be made during the rainy season as well as during summer and winter. Identification and classification of fungi will be conducted; it is expected that seasonal changes of their types will give useful information on taxonomical and ecological aspects. Techniques of isolation and inoculation will be developed. The symbiotic efficiency of different fungal species under different ecological conditions will be investigated later.

/forest trees/ /fungi/

*** /ectomycorrhizae/ /endomycorrhizae/ /pinus/ /inoculation/

AFFORESTATION AND MYCORRHIZA

Grantee D218: Mr Rasheed Gbadegesin, Savanna Forestry Research Station, Forestry Research Institute of Nigeria, P M B 1039, SAMARU, Zaria, Nigeria

"Mycorrhizal relationships of Pinus species in Nigeria"

IFS funding: 16500 SEK 1977 21500 SEK 1979

Large pine plantations are being established in Nigeria to produce long fibre pulp for the pulp and paper industry. Fungi that form mycorrhiza with pines do not occur naturally in the soils and must therefore be introduced to promote growth. Mycorrhizal endophytes that withstand the specific climatic conditions will be isolated and identified and suitable culture techniques will be developed. Their effect on growth and nutrient status of seedlings of P. oocarpa and P. caribaea will be studied under greenhouse, nursery, and field conditions. The impact of different cultural treatments on mycorrhizal infection will be determined, as well as yield of seedlings of Pinus spp. Introduction of mycorrhizal fungi into soil will be carried out by spore inoculation of seeds. This project is complementary to the successful work with Pisolithus tinctorius carried out by Dr Z O Momoh (IFS grantee No D012).

/fungi/ /afforestation/

*** /ectomycorrhizae/ /pinus/ /inoculation/

AFFORESTATION AND MYCORRHIZA

Grantee D219: Dr Soetrisno Hadi, Universitas Mulawarman, Jalan
P Flores 1, KALIMANTAN, Timor, Indonesia

"Mycorrhiza associated with Pinus merkusii"

IFS funding: 17600 SEK 1977 4400 SEK 1979

At present infected soils collected from Pinus merkusii forests are used to establish mycorrhiza in new pine plantations. This method may be costly and the risk of introducing soil-borne pathogens in forests as well as in agricultural crops may be a problem. The anatomical and morphological structures of mycorrhiza associated with P. merkusii will be described. The mycorrhizal fungi will be isolated and identified, and proper inoculation techniques developed. The effects of soil factors on the development of mycorrhiza will be determined and the isolates promoting the best growth of P. merkusii will be selected.

/afforestation/ /fungi/

*** /ectomycorrhizae/ /pinus/ /inoculation/

Grantee D221: Dr Ligia Perez, Facultad de Ciencias Agrícolas,
Universidad Nacional de Colombia, Apartado 568,
MEDELLIN, Colombia

"Study of the endo- and ecto-mycorrhiza in some important
agricultural and forestry crops"

IFS funding: 23700 SEK 1975 13200 SEK 1977

Samples of symbionts will be examined to identify and describe different types of mycorrhiza, with special emphasis on maize and pine species from the eastern region of Antioquia in Colombia. Later, artificial inoculation will be tested in the laboratory and the effect of the mycorrhiza association determined from the results of field inoculations.

/maize/ /fungi/

*** /endomycorrhizae/ /ectomycorrhizae/ /pinus/ /inoculation/

AFFORESTATION AND MYCORRHIZA

Grantee D222: Dr Kanthi Abeynayake, Department of Botany,
University of Colombo, COLOMBO 3, Sri Lanka

"The study of mycorrhiza and microorganisms in forest soils"

IFS funding: 44000 SEK 1977 27000 SEK 1978

Fungal associations with forest trees will be identified and their effect on the establishment and growth of forest trees will be studied. Pinus plantations in the dry zone will be given particular attention, since growth in these plantations has not been satisfactory. A survey, isolation, and identification of native microorganisms might prove useful for inoculation and hence the establishment of Pinus plantations.

/afforestation/ /forest trees/ /microorganisms/ /fungi/

*** /mycorrhizae/ /pinus/ /inoculation/

Grantee D251: Mr Ricardo Herrera P, Instituto de Botánica,
Academia de Ciencias de Cuba, Calzada del Cerro
1257, Cerro, HABANA 6, Cuba

"Vesicular-arbuscular mycorrhiza as an aid to afforestation"

IFS funding: 24000 SEK 1977 44800 SEK 1981

Mr Herrera will study the ecophysiology of vesicular-arbuscular mycorrhiza (VAM) and associated fungi in trees and grasses typical of degraded forests in Cuba. VA-endophytes have been identified in five of the most important Cuban forest trees, viz, Calophyllum antillanum, Cedrella odorata, Cordia alliodora, Hibiscus elatus and Swietenia macrophylla mahagoni. These species will be used as hosts in the project. The taxonomy of Endogonaceae spp. and also fungi life cycles will be studied to better understand the symbiotic interaction of different spore types, the fungal growth in different soils types and the penetration of hyphae into roots. The most efficient fungi will be selected by growth trials on host species. The results may assist plantation of desired species in degraded soils.

/afforestation/ /forest trees/ /fungi/

*** /endomycorrhizae/

AFFORESTATION AND MYCORRHIZA

Grantee D252: Mr M Afzal Chaudhry, Department of Forestry,
Makerere University, P O Box 7062, KAMPALA,
Uganda

"Ontogeny of mycorrhiza on pines under conditions in Uganda"

IFS funding: 17280 SEK 1977 13330 SEK 1979
 56000 SEK 1981

The ectomycorrhiza of the major pine species introduced in Uganda, Pinus patula, P. Caribaea, P. radiata and P. oocarpa will be studied in different climatic and edaphic zones and with respect to mycorrhizal nature, growth, development and characterization. Mycorrhiza, soil and fruiting body samples will be collected and their macro- and microscopic characters described. The horizontal and vertical distribution will be assessed by regression analysis against physical and chemical properties of the soil. The propagation of the fungal symbiont as it occurs in nature will be investigated.

/afforestation/ /fungi/

*** /ectomycorrhizae/ /pinus/ /inoculation/

Grantee D275: Dr U P de S Waidyanatha, Rubber Research
Institute of Ceylon, Research Laboratories,
Dartonfield, AGALAWATTA, Sri Lanka

"Effect of endomycorrhiza on growth and nutrient uptake in rubber (Hevea) and leguminous ground covers"

IFS funding: 18800 SEK 1978 25800 SEK 1979

Ground cover legumes improve the nitrogen supply for early growth of rubber trees. Legumes and rubber trees are observed to depend on endomycorrhiza, presumably for more effective phosphorus uptake. It may be possible to replace imported rock phosphate by inferior but locally-available apatite. A survey of vesicular-arbuscular (VA) endophytes will be made in soils of rubber plantations and if necessary an inoculation programme will be undertaken. Comparative studies with isolated strains will be carried out and their effect on growth and nutrient uptake assessed. Research on a triple symbiosis between legume, rhizobium and VA-mycorrhiza will also be undertaken.

/leguminosae/ /rubber/ /fungi/ /nitrogen fixation/

*** /endomycorrhizae/

AFFORESTATION AND MYCORRHIZA

Grantee D276: Dr Illeperuma Gunatilleke, Department of Botany,
University of Peradeniya, PERADENIYA, Sri Lanka

"Vertical distribution and determination of certain activities
of the microbial flora in a tropical rain forest"

IFS funding: 23500 SEK 1978 26250 SEK 1983

Tropical rain forests have a high productivity achieved and maintained through effective recycling of nutrient elements. The substrates of plant litter and animal debris are broken down by microbial decomposers and made available to soil and root systems. A study of the vertical distribution of micro-fungi, microbial decomposition patterns, respiratory activity and N₂-fixing capacity of the soil microorganisms will be made at Sinharaja Forest. A comparative study will be made in the neighbouring deforested areas which have now become unproductive fernlands. A survey of the mycorrhizal associations of the endemic plants, which constitute a high proportion of the species composition of the forest, will also be carried out. This information will be used to plan reforestation programmes.

/afforestation/ /microorganisms/ /fungi/

*** /mycorrhizae/ /tropical rain forests/

Grantee D313: Mr Alphonse Kabre, Centre National de Recherches
Forestières, Institut Sénégalais de Recherches
Agricoles, (ISRA), B P 2312, DAKAR, Senegal

"Influence of mycorrhiza and P solubilising bacteria on growth
and mineral and water uptake in Pinus caribaea in Senegal"

IFS funding: 29700 SEK 1978 41000 SEK 1981
Completed 1982

The Casamance region in Senegal has a good potential for forest production and a programme for plantation of Pinus caribaea has already been started. Mr Kabre will try to improve growth, and mineral and water uptake by inoculation on the pine seedlings with the fungi Pisolithus tinctorius and Phlebotopus colossus, and by inoculation of the soil with P solubilising bacteria. The relationship between the two inocula will be studied and methods for their inoculation will be developed.

/bacteria/ /fungi/ /afforestation/

*** /ectomycorrhizae/ /pinus/ /inoculation/

AFFORESTATION AND MYCORRHIZA

Grantee D314: Mr Rodney Nkaonja, Department of Forestry,
P O Box 30048, LILONGWE, Malawi

"Breeding of Eucalyptus spp. for the dry zones in Malawi"

IFS funding: 36000 SEK 1978

Eucalyptus is becoming an important genus of tree in the dry zones of Malawi. Imported seeds from unselected natural populations have been tried to determine the most productive, drought tolerant species, and the preliminary results are promising. The genetic variability in these plantations is considerable, and selection and breeding programmes with the promising species will be initiated. Mr Nkaonja will make selections in the already existing plantations. Grafting and artificial pollination experiments and progeny tests will be conducted to develop varieties with high productivity in a dry climate. Seed orchards of the improved varieties will be established to ensure self-sufficiency in good quality seeds.

/genetic improvement/

*** /eucalyptus/ /seed production/

Grantee D348: Dr Gilbert Okombi, Centre Technique Forestier
Tropical, B P 764, POINTE-NOIRE, Congo

"Propagation of Pinus caribaea for paper production in Congo"

IFS funding: 44000 SEK 1979 47040 SEK 1981
Completed 1983

Efforts are being made to develop a paper and pulp industry in Congo. Availability of wood of homogenous quality is important for this purpose. To improve the plantations, Dr Okombi will select from existing plantations suitable phenotypes of Pinus caribaea which will be subjected to controlled pollination. Top cuttings and grafts will also be taken from greenhouse propagation.

*** /pinus/ /species selection/ /vegetative propagation/

AFFORESTATION AND MYCORRHIZA

Grantee D392: Dr Lee Kyung Joon, Institute of Forest Genetics,
P O Box 24, SUWEON, Geonggido, 170, Republic of
Korea

"Distribution and formation of mycorrhiza in pines in Korea"

IFS funding:	25800 SEK 1979	39600 SEK 1980
	39200 SEK 1981	Completed 1983

South Korea is to a large extent covered by forests. The soil in these areas is often poor and cannot support trees. Dr Lee will make a survey of the natural distribution of pine ectomycorrhiza and identify the mycorrhizal fungi. The nitrogen and phosphorus contents of the soil will be examined, as well as the nitrogen fixation capacity of the different mycorrhiza species. Pine seedlings will be inoculated with the promising strains, and their survival and growth rate recorded.

/afforestation/ /fungi/ /nitrogen fixation/

*** /ectomycorrhizae/ /pinus/ /inoculation/

Grantee D393: Dr Emmanuel Owusu-Bennoah, Department of Crop
Science, University of Ghana, Faculty of
Agriculture, P O Box 44, LEGON, Ghana

"Effect of mulching and vesicular-arbuscular mycorrhiza on
nutrient availability and crop yield"

IFS funding: 21500 SEK 1979

Mulching can greatly increase the growth and yield of many economically important crop plants through its effect on the biological, chemical, and physical properties of the soil. It has earlier been shown that vesicular-arbuscular mycorrhiza (VAM) adds to phosphate uptake and growth. Dr Owusu-Bennoah will study the combined effect of mulching and inoculation of VA endophytes. A survey of the different mycorrhizal strains occurring in the soils will be made and promising endophytes adapted to the particular environment selected. The relative merits of different mulches combined with inoculation of different endophytes will be evaluated.

/food crops/ /fungi/

*** /endomycorrhizae/ /inoculation/

AFFORESTATION AND MYCORRHIZA

Grantee D477: Mr Nguyen Sy Giao, Institut de Recherches
Forestières du Vietnam, Tu-Liem, HANOI, Viet Nam

"Mycorrhiza of exotic pines in Viet Nam"

IFS funding: 26400 SEK 1980 Completed 1983

There are more than 7 million hectares of bare hills and mountains in Viet Nam. Afforestation of these zones is an urgent problem for their ecological protection and for the economy of the country. In order to contribute to this aim, exotic pine species have been introduced into Viet Nam during the past few years. Mr Nguyen will study the importance of the presence of mycorrhiza for the survival and growth of the introduced exotic pine species under nursery and field conditions. Attempts will be made to identify the naturally occurring mycorrhizal fungi and to compare their efficiency with introduced foreign strains. Inoculation techniques will also be experimented upon.

/afforestation/ /fungi/

*** /endomycorrhizae/ /pinus/ /inoculation/

Grantee D478: Mr Vien Ngoc Hung, Institut de Recherches
Forestières du Vietnam, Tu-Liem, HANOI, Viet Nam

"Improvement of the impoverished forests in Viet Nam by
integrating agricultural crops with tree plantations"

IFS funding: 44000 SEK 1980

At present, forest tree species in Viet Nam are mainly indigenous. Most of the forests have been exploited at random and left for natural regeneration. Mr Vien will create, on an area of 1 000 hectares, a model forest by planting trees to produce construction wood and precious wood, in combination with agricultural crops suited to local conditions. The best combination of trees and crops will be determined to obtain consistent and high yields.

/agroforestry/ /trees/ /food crops/ /wood products/

AFFORESTATION AND MYCORRHIZA

Grantee D525: Mr Mohamed Abourouh, Division de la Recherche Forestière, B P 763, RABAT-AGDAL, Morocco

"Mycorrhization in nursery plantations"

IFS funding: 30000 SEK 1981

In Morocco, afforestation operations have a high percentage of losses. This is believed to be due to lack of mycorrhization. Mr Abourouh will produce, in the nursery, seedlings inoculated with selected fungi to render them more resistant to disease and drought. He also intends, with these fungi, to improve the young plant's growth, especially during the first four years.

/fungi/ /forest trees/

*** /ectomycorrhizae/ /inoculation/

Grantee D526: Mr Beka Siki, Lae City Interim Authority, P O Box 1333, LAE, Papua New Guinea

"An examination of the interaction between Leucaena leucocephala and Ipomea batatas when inter-planted at various spacings"

IFS funding: 32500 SEK 1981

At present, there is no available information in Papua New Guinea on the interactions between the density of planting of Leucaena leucocephala and food crops and their respective yields and growth rates. Such data would be valuable for the successful implementation of agroforestry systems which would contribute to the firewood demands of the country. Mr Siki will study the variations in growth rate and yield of L. leucocephala and Ipomea batatas (sweet potato), in order to make recommendations on plant spacings of these crops in the Atzera Range and Lae environment. He will also investigate the long-term effect of L. leucocephala culture on soil fertility.

/agroforestry/ /leguminosae/ /trees/ /sweet potatoes/

AFFORESTATION AND MYCORRHIZA

Grantee D561: Mr Ounoh Nadjombe, Office de Développement et
d'Exploitation des Forêts, (ODEF), B P 334, LOME,
Togo

"Selection and vegetative multiplication of Eucalyptus species
in Togo"

IFS funding: 44800 SEK 1981 57375 SEK 1983

In Togo, large areas of forests and savannas are being
exploited as a result of the increasing needs for wood and
charcoal. In order to slow down the deforestation of these
zones, Mr Nadjombe will establish a selection programme in order
to obtain eucalyptus species capable of producing 25 m³/ha/year
after six years, which could be used for intensive reforestation
programmes. The selected species will be propagated by
vegetative multiplication.

/afforestation/

*** /eucalyptus/ /vegetative propagation/

Grantee D562: Mr Balle Pity, Centre Technique Forestier
Tropical, 08 B P 33, ABIDJAN 08, Ivory Coast

"Ecology and silviculture of the 'Frake' (Terminalia superba)
and of the 'Samba' (Iriplachiton scleroxylon)"

IFS funding: 44800 SEK 1981

Mr Pity will study the ecology of the 'Frake' and the 'Samba' in
their natural habitat in Ivory Coast. He will then utilize his
results to improve plantation techniques, thereby accelerating
afforestation programmes in the country.

/ecological research/ /forest trees/ /afforestation/

AFFORESTATION AND MYCORRHIZA

Grantee D563: Dr Chuntana Suwanthada, Faculty of Agriculture,
Chiang Mai University, CHIANG MAI, Thailand

"Agroforestry systems for rain-fed upland area"

IFS funding: 56000 SEK 1981

This project aims at finding a suitable combination of plants and animals in an agroforestry system for the upland wet area of Chiang Mai. Economic studies will be carried out with different combinations of fast-growing wood lot (Acacia sp.), soil improving crops (Ervthrina sp.), fruit tree (Mangifera indica), and short cycle cash crops (Lab-lab purpuria), Gladiolus, and also animals (geese in pasture). Each combination will be tested in an area of two acres which is the average size of farms in the project area.

/mixed farming/ /agroforestry/ /trees/ /food crops/ /animal
production/

Grantee D564: Dr Tan Sai Tee, School of Biological Sciences,
Universiti Sains Malaysia, MINDEN, Penang,
Malaysia

"Symbiotic nitrogen-fixation in the genus Casuarina and its contribution to the productivity of sandy soils of the East Coast of peninsular Malaysia"

IFS funding: 48160 SEK 1981

The genus Casuarina is the most economically important species of the group of non-legume angiosperms capable of forming root nodules which can fix nitrogen. It is used as a source of timber, fuel, tannin, dye and medicinal preparations. This project aims at establishing the nature and characteristics of the symbiotic relation between Casuarina and its symbiont, an actinomycete. It will also assess their contribution building up the soil nitrogen in sandy areas.

/nitrogen fixation/

*** /casuarina/ /root nodulation/ /sandy soils/

AFFORESTATION AND MYCORRHIZA

Grantee D565: Mr Solomon Chipompha, Forestry Research Institute of Malawi, P O Box 270, ZOMBA, Malawi

"Performance of indigenous and exotic mycorrhizal fungi in Malawi's pine afforestation programme"

IFS funding: 49280 SEK 1981

This project aims at investigating the feasibility of using pure cultures and more defined inocula of mycorrhizal fungi under various ecological conditions. Emphasis will be placed on determining the influence of mycorrhizal infection of pine roots by indigenous and selected exotic fungi on the growth of the pines, as well as the cost of the inoculations. The initial stages of the project will be under laboratory conditions and inoculation techniques identified and tested in the field.

/afforestation/ /fungi/

*** /ectomycorrhizae/ /pinus/ /inoculation/

Grantee D566: Mr Wong Jiahn-Yaor, Asian Vegetable Research and Development Center, P O Box 42, SHANHUA, Tainan 741, Taiwan, Province of China

"The role of vesicular-arbuscular mycorrhizae (VAM) in vegetables and legumes of paddy-rice-based cropping systems"

IFS funding: 56000 SEK 1981

The current high costs of pesticides and fertilizers have imposed yield limitations on crops of less importance than rice such as vegetables and legumes. The productivity of these crops may be increased through a better understanding of the interrelationship between vesicular-arbuscular mycorrhiza (VAM) and vegetable and legume host plants. Mr Wong will explore the relationships between VAM populations (residual and introduced), nutrient uptake, fertilizer usage, soil pathogen populations and pesticides. He will also examine mycorrhizal dependency of crop plants and the population dynamics of the various genera and species of mycorrhizae during the cropping sequence.

/food crops/ /leguminosae/ /rice/ /fertilizers/ /pesticides/

*** /endomycorrhizae/

AFFORESTATION AND MYCORRHIZA

Grantee D567: Dr Bunvong Thaiutsa, Faculty of Forestry,
Kasetsart University, BANGKOK 9, Thailand

"Revegetation of tin-mined lands"

IFS funding: 56000 SEK 1981

Tin mining is a major factor in soil deterioration in Southern Thailand. It was estimated recently that the abandoned areas might be over 200 000 acres. This project aims at reclaiming such areas through revegetation by appropriate plant species including grasses, shrubs and trees. Those species will be selected on the basis of their root systems, rates of litter decomposition and capacity of improving soil fertility. The planted crops will then be treated with different levels of fertilization and watering. Soil and foliar analyses, plant growth surveys in terms of plant cover percentage, height, above-ground production, and below-ground biomass, will be conducted during the last stage of the project.

/trees/ /grasses/ /soil conservation/

*** /shrubs/

Grantee D580: Dr Kovith Yantasath, Thailand Institute of
Scientific and Technological Research, (TISTR),
196 Phahonyothin Road, Bangkok, BANGKOK 9,
Thailand

"Study on vesicular-arbuscular mycorrhiza (VAM) and its
combined effects with nitrogen-fixing bacteria in leguminous
plants"

IFS funding: 45080 SEK 1982 74400 SEK 1983

Most tropical soils are poor in phosphate. To improve plant production in such soils, the use of fertilizer is required, which is a costly and, in many cases, inefficient technique. This project aims at studying the soil-borne vesicular-arbuscular mycorrhiza (VAM) in Thailand, and its effects on plant growth and mineral utilization, especially slow-releasing phosphate. The combined effects of VAM and nitrogen-fixing bacteria in leguminous plants will also be studied.

/leguminosae/ /fungi/ /bacteria/ /nitrogen fixation/

*** /endomycorrhizae/ /inoculation/

AFFORESTATION AND MYCORRHIZA

Grantee D605: Mr Abdou Soumeylo, Institut Polytechnique Rural de Katibougou, B P 6, KOULIKORO, Mali

"Studies on the physiology of Acacia albida"

IFS funding: 58000 SEK 1982

Acacia albida is a shrub of the mimosaceae family which grows in the Sahel countries in Africa. This shrub is of particular value in that it loses its leaves only during the humid season. It can thus be used during the dry season as a forage crop. Mr Soumeylo will study the morphogenesis of the root system as well as the influence of the seasonal variations on the rate of production of the endogenous hormone responsible for the loss of the leaves. A better comprehension of the phenomena involved in the 'out-of-season growth' could be of considerable importance in tropical countries with a prolonged dry season.

/hormones/ /physiology/ /forage crops/

*** /acacia/

Grantee D644: Mr Ousmane Diagne, Centre National de Recherches Forestières, Institut Sénégalais de Recherches Agricoles, (ISRA), B P 2312, DAKAR, Senegal

"Effect of some root endophytes on local leguminous trees"

IFS funding: 67500 SEK 1982

Afforestation programmes in semi-arid zones are facing a variety of limitations. Important improvements can be envisaged, particularly from the nutritional point of view, i.e., nitrogen and phosphorus uptake through the introduction and development of symbiotic association. Mr Diagne will first verify whether there are symbionts such as rhizobia or mycorrhiza in the following species: Albizzia ferruginea, Parkia biglobos, Cordia pinnata, Prosopis juliflora and Erythrophleum guineensis. Techniques will then be developed in the laboratory to isolate and multiply the strains in view of measuring their efficiency. The main aim will be to develop a simple inoculation method for nursery operations that could be implemented by the afforestation service in Senegal.

/leguminosae/ /fungi/ /bacteria/ /afforestation/

*** /mycorrhizae/ /rhizobium/ /inoculation/

AFFORESTATION AND MYCORRHIZA

Grantee D645: Mr Mamadou Dione, Centre National de Recherches Forestières, Institut Sénégalais de Recherches Agricoles, (ISRA), B P 2312, DAKAR, Senegal

"Water economy and the development of arabic gum trees (Acacia Senegal) in the Sahel zone in Senegal"

IFS funding: 75000 SEK 1982

In addition to the fact that gum trees produce gum arabic and firewood, these trees also improve soil fertility and are effective in preventing soil erosion. They are well adapted to the Sahel region and are therefore an ideal species for reforestation, especially in areas threatened by desertification. In order to improve the establishment of gum tree plantations in Senegal, Mr Dione will determine the water requirements for their optimal growth and will study the effect of different cultivation techniques on the water economy in the plantations as well as the resistance of the gum trees to drought.

/water conservation/ /cultivation practices/ /wood/ /gum arabic/
/erosion control/

*** /acacia/ /drought resistance/

Grantee D646: Mr Manuel Villamar, College of Agriculture and Forestry, Don Mariano Marcos Memorial State University, BACNOTAN, La Union, Philippines

"Agroforestry models for upland areas in the Philippines"

IFS funding: 37500 SEK 1982

Mr Villamar will devise farming technologies suited to the hilly lands of the northern part of the Philippines, aiming towards agroforestry systems integrating tree crops, plantation crops, catch crops and animal production. Fast-growing and economic trees will be evaluated. The performance of plantation crops under fast-growing trees will be analyzed to determine the feasibility of their integration. Thereafter, the best catch crops will be determined and the integration of animals studied.

/mixed farming/ /trees/ /food crops/ /animals/ /agroforestry/

*** /fast-growing trees/

AFFORESTATION AND MYCORRHIZA

Grantee D682: Mr Simon Saulei, Biology Department, University
of Papua New Guinea, Box 320, WAIGANI, Papua New
Guinea

"Regrowth of tropical forests after disturbance"

IFS funding: 72000 SEK 1983

This project will evaluate the nature of regeneration of tropical forest plant species in areas where clearing of forests by chip mill logging operation practices occur. Mr Saulei will establish control and experimental plots of 5 x 200 m each and seed traps in both closed forests and cleared areas. Soil samples will be collected for chemical analyses and a soil seed bank study will be carried out. Phenological observations of a few major forest trees will also be performed and meteorological data recorded.

/forest trees/ /reforestation/ /soil analysis/

Grantee D683: Ms Su See Lee, Department of Forest Management,
Faculty of Forestry, Universiti Pertanian
Malaysia, (UPM), SERDANG, Selangor, Malaysia

"The mycorrhiza of some forest trees in Malaysia"

IFS funding: 52500 SEK 1983

This project attempts to find whether there exists indigenous mycorrhizal trees which can easily be established, have rapid growth on particular sites, and potential as plantation species. Ms Lee will carry out a survey to investigate the role of mycorrhiza in the establishment of some indigenous rain forest trees. An attempt will be made to identify the fungi involved as well as to determine host specificity between fungus and host plant. She will also try to relate the occurrence of mycorrhizal associations with site characteristics.

/forest trees/ /fungi/

*** /mycorrhizae/

AFFORESTATION AND MYCORRHIZA

Grantee D684: Ms Azizah Hashim, Department of Soil Science,
Faculty of Agriculture, Universiti Pertanian
Malaysia, (UPM), SERDANG, Selangor, Malaysia

"Effect of the elite strains of endomycorrhiza on the growth
response of winged beans (Psophocarpus tetragonolobus)"

IFS funding: 42000 SEK 1983

Very little experimental work has been done on vesicular
arbuscular mycorrhiza (VAM) of tropical crops, especially in
Malaysia. Ms Hashim will sample various soil types for the
presence of VAM fungal spores. The spores will then be
identified. Pot and field trials will be carried out to test the
effect of VAM inoculation on the winged bean at five rates of
applied phosphorus. Plant response to double inoculation (VAM
and rhizobium) will also be studied.

/beans/ /fungi/ /bacteria/

*** /endomycorrhizae/ /inoculation/

Grantee D685: Dr Abdulla Khaliel, Department of Botany, College
of Science, King Saud University, RIYADH, Saudi
Arabia

"The role of mycorrhizal fungi in sand stabilization in Saudi
Arabia"

IFS funding: 37500 SEK 1983

Dr Khaliel will carry out a survey to investigate the mycor-
rhizal status of the sand dune plants in different areas in
Saudi Arabia with special reference to the Quassim area. He will
sample various types of soil infested with mycorrhizal fungi as
well as host plants. He will also attempt to identify the fungi
and conduct physical and chemical analyses of infested soil
samples. The selected mycorrhizal fungi will be tested to detect
their significance in aggregating sandy soil particles.
Moreover, the project will verify whether selected mycorrhizae
could enhance the survival and growth of mycorrhizal plants in
harsh sandy dune conditions.

/soil conservation/ /fungi/

*** /mycorrhizae/ /sandy soils/

AFFORESTATION AND MYCORRHIZA

Grantee D726: Dr Denis Amara, Department of Agronomy, Njala University College, University of Sierra Leone, Private Mail Bag, FREETOWN, Sierra Leone

"Biological nitrogen fixation in fast-growing tree legumes"

IFS funding: 80000 SEK 1983

Local and exctic species of Leucaena and Gliricidia will be propagated in representative upland soils of Sierra Leone. Their nodulation will be assessed, rhizobia isolated, and effectiveness tested according to established rhizobiological techniques. Studies will also be conducted to determine the effect of enviornmental factors on selected strains under conditions characteristic of Sierra Leone soils. Strains which demonstrate the best symbiosis and ability to survive in the soils will be used to inoculate tree legumes which will be introduced into the agroforestry systems of Sierra Leone.

/trees/ /leguminosae/ /bacteria/ /agroforestry/ /nitrogen fixation/

*** /inoculation/

Grantee D727: Dr Oscar Eyog Matig, Centre de Recherches Forestières, B P 2102, YAOUNDE, United Republic of Cameroon

"Silvicultural studies in the Sudanese savannah plant-soil relations"

IFS funding: 72000 SEK 1983

The fuelwood shortage in the Sahel zone has led to the systematic pillage of the few remaining forests. One way of reversing this situation is to plant tree species that are both fast growing and adapted to the environment. Preliminary trials of exotic species such as Eucalyptus camaldulensis, Acacia holosericea and Cassia siamea have shown that performance varies according to soil properties and the depth of the water table. Dr Eyog Matig will study the soil properties, water dynamics and root penetration of the trees in experimental plots. The ultimate objective is to provide recommendations on which tree species are best adapted to the soils.

/forest trees/ /soils/ /water resources/

AFFORESTATION AND MYCORRHIZA

Grantee D728: Mr Bassirou Sougoufara, Direction des Eaux et Forêts, Ministère de la Protection de la Nature, DAKAR, Senegal

"Study of Frankia inoculation and its combined effects with vesicular-arbuscular mycorrhiza (VAM) in Casuarina equisetifolia"

IFS funding: 80000 SEK 1983

The importance of Casuarina sp. in fuelwood production and in soil stabilization in the tropics has now been recognized in Senegal. Recent studies have shown great generic variability in the plantations of C. equisetifolia. Mr Sougoufara will carry out a preliminary selection of about ten clones of C. equisetifolia based on their ability to nodulate and fix nitrogen. A pure strain of Frankia and a VAM strain, Glomus mosseae, will be used to inoculate C. equisetifolia.

/fungi/ /bacteria/

*** /endomycorrhizae/ /casuarina/ /inoculation/

Grantee D729: Mr Jean Koyo, Centre Technique Forestier Tropical, B P 764, POINTE-NOIRE, Congo

"In vitro culture of Terminalia superba"

IFS funding: 64000 SEK 1983

Terminalia superba is a tree species used in afforestation programmes in the Congo. Methods of propagation by cuttings of selected material have been developed in order to mass produce plants of high quality for an industrial plantation project of 25 000 hectares. As the level of rejuvenation reached is not satisfactory, Mr Koyo will use instead an in vitro culture technique. Methods will be developed to disinfect the vegetative material before it is used. The composition of a culture medium will be determined. Different in vitro culture methods will be carried out using buds, internodes and leaves. The methods will be compared in terms of the risk for genetic deviation. Root formation and root penetration studies will be performed before the in vitro plants are transferred to the fields.

/afforestation/ /forest trees/

*** /vegetative propagation/ /tissue culture/

AFFORESTATION AND MYCORRHIZA

Grantee D730: Mr Zhao Bin, Department of Soil Science and Agrochemistry, Huazhong Agricultural College, WUHAN, China

"Effects of vesicular-arbuscular mycorrhiza (VAM) fungi on cotton and its applicability to cotton cultivation"

IFS funding: 76000 SEK 1983

Cotton is a major fibre crop in China. Most cotton crops are grown in phosphate deficient soils. Phosphate deficiency is one of the major causes of lower yields. Previous experiments have proved that artificial inoculation of VAM gives a marked increase in yield compared with the VAM-free cotton. Mr Zhao will collect and select efficient strains of VAM fungi from different soils. The comparison of the different strains will be made in pot experiments. Suitable host plants for the maintenance and the multiplication of the VAM fungi will be selected. Field experiments on the application of VAM on cotton cultivation in seedling blocks will also be performed.

/cotton/ /fungi/

*** /endomycorrhizae/ /inoculation/

Grantee D731: Dr Somkind Siripatanadilok, Department of Forest Biology, Faculty of Forestry, Kasetsart University, BANGKOK 9, Thailand

"Utilization and propagation of Aquilaria species"

IFS funding: 40000 SEK 1983

Calumbac or aloes-wood is found on the stem of Aquilaria spp. Calumbac is used to make joss sticks, an incense burned in Indian and Arabic ceremonies. Top grade calumbac costs about USD 800 per kilogram and even at this price demand far exceeds supply. The cause of calumbac formation is unknown. Dr Somkind Siripatanadilok will investigate the potential causes of aloes-wood formation on Aquilaria agallocha as well as the possibility to induce the formation of aloes-wood by biological, chemical or mechanical means. Propagation trials of Aquilaria spp. through seeds and vegetative organs will also be carried out in order to provide seedlings to growers.

/forest trees/ /forest products/

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