

PROGRESS REPORT ON RESEARCH ACTIVITIES AT CNPSD, MANAUS, AM
JUNE 1984 TO JUNE 1985

1. Name of Consultant:

Dr Tow Ming Lim, Plant Pathology Specialist

2. Period:

1 June 1984 to 31 May 1985

3. Title of Project:

Agricultural Research in Brazil, Project n^o II.SB.1 (Epidemiology and Control of Rubber Diseases)

4. Name of Activity:

Technical co-operation to strengthen the research progress of the CNPSD, Activity n^o K.02.SB.1.11.

5. Type of Activity:

Research

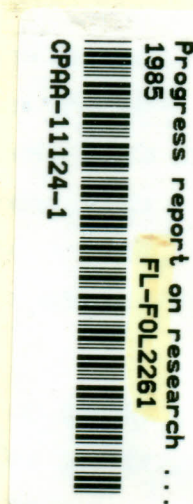
Research and supporting

Training

Others

6. Local:

CNPSD, Manaus, AM.



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7. Description of Activities and Results

The various activities planned for 1985 under the 4 areas of research identified and established for the 2-year IICA-EMBRAPA Contract assigned project entitled, "Epidemiology and Control of Leaf Diseases" (Lim, 1984), are as described under "Plan of Activities for 1985" (Lim, 1985a). Earlier, the research and development (R & D) activities executed during 1984 (including last quarter of 1983) along with the results obtained, have been reported (Lim, 1985b, "Annual Report for 1984"). A single comprehensive report, in fact, is now under compilation, to cover the whole 2-year contract consultancy period that started at CNPSD on 2 September 1983. This is scheduled for submission before the contract terminates at the end of August this year.

The present following progress report, designed mainly to cover the R and D work for the period January to June 1985, is briefly given hereunder, under the various assigned codes adopted from the outset. However, in compliance with the request received and for completeness sake, due references will be made to the results obtained during the previous 6 months (June-December, 1984), wherever relevant and without becoming repetitive.

Activity Code 5.11: Disease detection and new outbreaks: The project was aimed at ascertaining more exactly the number and relative importance of all the rubber leaf-defoliating parasites, besides the 3 already recognised (*Microcyclus*, *Thanatephorus* & *Colletotrichum*), responsible for the virtual year-round "leafless" state of clones like IAN 717, IAN 873 and Fx 3899 widely planted under the PROBOR I and II Project in many parts of the Amazonia. This is a pre-requisite, in clearly or fully defining the problem, before testing and securing the appropriate chemical protectants to treat the estimated 75,000 ha of clonal rubber implanted under PROBOR in the region. For new planting, disease avoidance through the use of clones with the desired resistance in the traditional "leaf-disease endemic" areas is only workable if the screening or evaluation process for lasting field resistance takes not only SALB into account, but also the other major leaf fall parasites, already known or in the process of discovery through intensified research.

Thus, in December during 1984, *Corynespora cassicola* as another major rubber leaf-defoliating fungal parasite was identified and described at CNPSD for the first time in Brazil (Gasparotto and Lim, 1985). Continuing this search, *Periconia manihoticola* and a new Ascomycete fungus causing leaf spotting and fall in clonal gardens and nurseries, were found at CNPSD during the first half of 1985 (Junqueira *et al*, 1985).

During the same period, the pathogenicity of a bacterium on *Hevea*, identified as a *Pseudomonas* sp. by collaborating bacteriologists at Viçosa University, MG., was conclusively established. A bacterial disease, with grave implications to *Hevea* well-being, is thus confirmed by Brazilian researchers for the first time in the world. Its discovery in Amazonas poses grave implications to effective control of leaf diseases that up to now are known to be caused by fungi exclusively.

Also, with no less than the same serious implications to the overall well-being of *Hevea* in the Amazonia, search during early 1985 in rubber field at CNPSD yielded definite virus symptoms on leaves on trees of clones. Collaborating virologists at CENARGEN, Brasília and University of Brasília, Brasília, confirmed the presence of virus particles in samples of such malformed, undersized or variegated leaves collected from the systemically affected stunted trees with drooping foliage or pre-mature flowering (Maria Gama I.C.S. da, Junqueira, N.T.V., *et al*, 1985).

While the planned comparative epidemiological studies on these leaf-defoliating agents have been initiated at CNPSD, a paper fully describing this new multi-agent serious "leaf disease complex" will be presented at the forthcoming 15th Congress of Brazilian Phytopathology scheduled for July 1985 at Fortaleza viz.

- (1) Junqueira, N.T.V.; Gasparotto, L.; Silva, H.M.e & Lim, T.M. Complexo de doenças foliares em seringueiras de cultivo no Estado do Amazonas. In: CONGRESSO BRASILEIRO DE FITOPATOLOGIA. 15, Julho, 1985, Fortaleza-Ce. Resume.

Also proposed for publication before September this year are 2 important papers reporting the first discovery on the occurrence on *Hevea* of a virus and a bacterial leaf disease. The first joint paper will be with collaborators from CENARGEN and University of Brasília, and the second with that from the University of Viçosa, MG.

Activity 5.12: Disease Epidemiology and Effects of Host, Climate and Soil

In support of the current protective scheme of chemical treatment against *Microcyclus* and *Phytophthora* leaf diseases, a long-term study to assess the relationships, if any, between the principal parameters of local prevailing weather, along with the relevant host clonal phenological features, and disease incidence/severity, was initiated on a national scale. From this, it was hoped eventually to formulate short-range *Microcyclus* and *Phytophthora* disease forecasting methods. Each will help optimise the timing and frequency of protective fungicidal application thereby improving treatment efficacy. Secondly, such a 3-factor relationship study will provide more definite meteorological criteria beside the annual moisture deficit parameter with which to more reliably define what, well in advance of any rubber planting, constitutes a permanent

"SALB-escape area".

Thus, by the last half of 1984, the main task of putting up the required minimum number of disease-weather observation stations was successfully accomplished in fields of clonal rubber in Amazonas (CNPDS, Manaus), Para (Convênio FCAP-EMBRAPA, Belém), south Bahia (Convênio CEPLAC-EMBRAPA, Itabuna) and Rondonia (UEPAE-P.V.).

To-date, data on local climate and disease incidence collected during the first SALB season during June-August 1984 were analysed for relationships on IAN 717, IAN 873 and Fx 3899 in Amazonas and for the same on IAN 717 in Para. In the first State, SALB severity was shown to be correlated negatively with the daily maximum temperature or positively with RH > 90% or daily rainfall (Lim, 1984b). In Para, during the month of July when maximum leaf fall took place due to *Microcyclus*, there was a minimum of 5 days with temperatures 24° - 28° C, accompanied by 14 days with RH > 95% persisting for more than 10 hours, conditions optimal for a SALB epidemic outbreak (Stein, R.L.B. & Nunes, M.A.L., 1985). Similar data from Rondonia and south Bahia have yet to be received at CNPDS or analysed by the respective collaborating counterparts.

At the time of this reporting, the 1985 *Microcyclus* or *Phytophthora* season has yet to arrive, the trees under experimental observation merely showing the early first sign of wintering, before refooliating and facing the consequent SALB attacks during July to August. The required data on weather, host and disease incidence for 1985 are being awaited. In a recent visit in June 1985 to São Paulo, a similar project will be set up this year, money for this having been provided under a World Bank Rubber Project for the State. (Rosa Maria, 1985).

Activity 5.13: Disease Control with Chemicals: This was a top priority project for 1984, to meet with the urgent practical needs of producers and as directed by EMBRAPA and requested by SUDHEVEA. As a result, some 9 pathologists from CNPDS and 4 of its co-operating units and 3 agricultural engineers (1 from CNPDS, 1 from IAC and 1 from CEPLAC) devoted most of their time to effect a total of 7 plantation-scale fogging/spraying trials in Bahia, Para, Amazonas, Acre and Rondonia, including 1 observation on commercial scale fogging at Itubera, during the annual SALB season from July-August last year.

Results of this initial 1984 evaluation suggest fogging with the new fungicide triforine (Saprol), and mancozeb (Dithane M-45) against SALB in Para, Amazonas and Rondonia, and Cursate and copper oxychloride (Coprantol) in Bahia against *Phytophthora*, to be of promise (Lim, 1985; Albuquerque *et al*, 1984).

Effectiveness of fogging was shown to be dependent on an increased dosage of fungicides as compared with those normally used in aerial spraying. Of equal importance were a correct timing and frequency of application, a proper control and specification of fogging machine, little or no rain interference and an ideal receptive stage of canopy during fogging.

For the fogging, the widely-used modified Leco 120-D proved adequate in upward dispersal of fungicides to the leaves, and of promise in controlling SALB and *Phytophthora*. For trees less than 8-10 m (or 6-9 years old) in height, fogging may be effectively made from the ground with a portable Puls-fog K20/0, treating the trees individually, as was shown in trials in Amazonas (Albuquerque *et al*, 1984). The trials had not included use of the new Jacto 2 fogging machine because it was then undergoing modification at CEPLAC workshop.

In ground spraying with modified portable or tractor-mounted sprayers in Rondonia and Amazonas, using the standard fungicides thiophanate methyl (Cercobin), mancozeb or triademephon (Bayleton), or the new chemical triforine, good control of SALB was achieved (Gasparotto *et al*, 1985).

For the follow-up work on fogging and spraying during July-August 1985, a repeat of some of these trials against SALB and *Phytophthora*, is needed with the inclusion of new fungicides against *Catacauma* and *Colletotrichum*. For work on field test of fogging machinery and its physical calibration, the required lab and field trials had duly been provided for execution in south Bahia (Albuquerque *et al*, 1984). These tests would include the new Jacto 2 fogger as well, if available.

On plan to develop a novel and more effective leaf disease control or management system, based on integrating fungicide/insecticide treatment by spraying or fogging with manuring and weed control, this was successfully tried out on 3 holdings badly diseased in Rondonia which required rehabilitation. Significance of the results (Gasparotto *et al*, 1985) lies in the fact that, where the rubber has been severely affected by SALB and pest attacks, protectant chemical treatment is enhanced by prior corrective manuring and weed control. In fact, this useful finding was quickly adopted by SUDHEVEA as a basis for drawing up a special rubber rehabilitation project entitled "PROMASE NORTH" for Acre, Rondonia and Amazonas. It is now scheduled for implementation in 1985/86 (SUDHEVEA, 1984).

In further support of this important project and refining this new "integrated approach" to leaf disease management or control for the Amazonia, follow-up trials in Amazonas have been planned. These will incorporate the use of chemical leaf

defoliant to advance and uniformise wintering and also pruning of terminals to encourage uniform refoliation, in order to reduce the number of expensive fungicidal treatment rounds while enhancing treatment effect.

The extensive activities developed on leaf disease control during the 1984 SALB season are duly reflected by the following 5 publications made on the topic, the significance of each being also given:

- (a) Consultancy report by Lim, T.M. on "A preliminary evaluation on thermal fogging for leaf disease control in Brazil". Prepared towards the end of 1984, it reported the promising good results of 1984 spraying/fogging trials suggested by Lim 1983.
- (b) Technical paper by Albuquerque, P.E.P.; Gasparotto, L.; Lim, T.M. & Corrêa, H.G. (1984) Recent progress in fungicide application technology for rubber leaf disease control. A review containing the 1984 fogging results plus the recently completed work in Brazil, it was read at the INTERNATIONAL WORKSHOP on SALB held at CEPLAC, Ilhéus, BA, 1984. This review is timely, to serve as a basis for current and future research.
- (c) Technical paper by Gasparotto, L.; Albuquerque, P.E.P.; D'Antona, O.J.G.; Ribeiro, I.A.; Rodrigues, F.M. & Lim, T.M. (1984) A suggested integrated approach to SALB disease control in the Amazonia. Boletim de Pesquisa, 1985. EMBRAPA/CNPDS, Manaus (no prelo). Based on the 1984 SALB season's results of 3 spraying/fogging trials in Rondonia, it was shown that application of fungicide combined with prior proper manuring and weed control, gave the best canopy growth and the least disease attack. Significantly, SUDHEVEA has adopted this results as the basis for the proposed "PROMASE NORTH" rubber rehabilitation programme for Acre, Rondonia and Amazonas to be implemented in 1985/86 (SUDHEVEA 1984).
- (d) Technical paper by Lim, T.M (1984) The epidemiology and control of *Phytophthora botryosa* on rubber. An invitation paper read at the 17th BRAZILIAN PHYTOPATHOLOGY CONGRESS, September, 1984, São Paulo, Abstr. The methodology and approach used in Malaysia to bring about the satisfactory control of *Phytophthora* (also a serious problem on rubber in south Bahia) were presented for open discussions and possible adoption by local pathologists.

- (e) Technical paper by Gasparotto, L. & Lim, T.M. Research on SALB (*Microcyclus ulei*) in Brazil - recent progress. In: INTERNATIONAL WORKSHOP ON SALB, Itabuna, BA, August, 1984. Anais. Brasília, SUDHEVEA (no prelo). A timely review of recent and current work on SALB.

In addition, 4 other progress reports prepared by local counterparts on the same topic of disease control during the year are as listed below:

- (i) PEREIRA, J.C.R.; ALBUQUERQUE, P.E.P.; SANTOS, A.F. & AZEVEDO, A.C. Projeto especial de termonebulização na Fazenda Cultrosa, Camamu-Ba. Relatório. Manaus, EMBRAPA-CNPSD, November, 1984. 3p.
- (ii) PEREIRA, J.C.R.; ALBUQUERQUE, P.E.P. & SANTOS, A.F. Projeto especial de termonebulização na Fazenda Três Pancadas, Camamu-BA. Relatório. Manaus, EMBRAPA-CNPSD, November, 1984. 19p.
- (iii) GASPAROTTO, L.; ALBUQUERQUE, P.E.P.; D'ANTONA, O.J.G.; RIBEIRO, I.A. & RODRIGUES, F.M. Recuperação de seringais em Ouro Preto do Oeste - Rondonia. Relatório. Manaus, EMBRAPA-CNPSD, October, 1984. 15p.
- (iv) ALBUQUERQUE, P.E.P.; PEREIRA, J.C.R. & SANTOS, A.V. dos. Programa de pesquisa de pulverização e termonebulização para controle de doenças da seringueira no sul da Bahia para 1985. Relatório. Manaus, EMBRAPA-CNPSD, December, 1984. 4p.

Significantly, the publication under (iv) was prepared based on problems revealed from commercial-scale fogging under (ii) that required prompt research. Towards this end, lines of new work were proposed therein to be implemented without delay by local counterparts in south Bahia from early 1985.

Activity 5.14: Field Disease Resistance Evaluation: Evaluation for clonal field resistance in breeders' trials forms an important initial part of work that will lead to a rational, discriminative use of long-lasting resistance under the Enviromax or Zonation recommendation scheme. In Brazil, a standardised method to evaluate the incidence or severity of above-ground diseases (Lim & Rao, 1973) is lacking. Because SALB is not the only leaf disease attacking the developing canopy, it becomes essential that the criteria used to denote leaf infection scores, number of diseased fallen leaves and the resultant canopy retention must be sought separately for each of them, and the assessment made also at the correct time of the year.

An study was therefore made during the period to work out suitable leaf disease assessment methods that best describe the clonal field susceptibility or resistance (as influenced by tree wintering/refoliation behaviour which is not the case with vertical resistance) towards *Microcyclus*, *Thanatephorus*, *Catacauma* and *Colletotrichum*.

Initial results from a trial assessment made on clone trials at CNPSD suggested that suitable parameters could be (a) periodic counts of fallen, diseased leaves in marked areas of fixed dimensions (b) infection score of leaves using a standard disease key to be evolved and (c) estimation of % canopy retention. The promising criteria are to be critically tested out especially during the 1985 disease season from July-August in 3 clonal trials at CNPSD.

5.21 Research Co-ordination and Monitoring

Frequent and close interactions were effected during the period with Chief of CNPSD and his technical and administrative heads, in respect of research planning, implementation, co-ordination and progress monitoring. The Centre being separated far from its co-operating units in the other States, frequent visits to hold discussions with counterparts outside Manaus were necessary.

These activities aimed at enhancing co-ordination and monitoring of work undertaken within CNPSD and outside Manaus took the form of formal and informal meetings. At CNPSD, a total of 15 formal meetings, chaired either by Dr. Valois or his technical chief were held. Outside Manaus 10 were recorded, with counterparts at the other co-operating units during the review period (see Annual Report for 1984 for details).

In an effort to promote co-operative research between CNPSD and some well-known local specialist researchers who show interest on *Hevea*, discussions were made on the named topics with the following:

Local Contacts

- (a) Prof. A. Bergamin and Dr. J.O. Menten of University of São Paulo at Piracicaba (epidemiology and host/parasite relations).
- (b) Dr. A.A. Ortolani and Maria J.P. of IAC, São Paulo (zonation scheme for rubber planting and meteorological equipment).
- (c) Profs. Chaves, G.M., and Dr. Kushalappa, A.C., of University of Viçosa (rubber diseases and epidemiology)

- (d) Profs. Katajima, E.E., and Lin, M.T., of University of Brasília (virus disease of rubber, follow-up studies)
- (e) Dr. H.M. Rocha of CENARGEN, Brasília (epidemiology of rubber diseases).
- (f) Drs. Stephen, A. Rudgard and Teklu, A of CEPLAC, Belém and Rondonia (epidemiology and control of diseases for cocoa and rubber)
- (g) Dr. Bezerra, J.L. of CEPLAC, Itabuna (rubber diseases and those of other plantation crops)
- (h) Bastos, T.X. of CPATU, PA (microclimate and rubber diseases)

International Contacts

Similarly, contacts through correspondence were established with specialist researchers or persons outside Brazil on the named topics below:

- (a) Director of Commonwealth Mycological Institute, Kew, England, Dr. Hawkesworth, D., its Chief mycologist, Dr. Sutton, B.C. and bacteriologist, Dr. Bradbury J.F. (identification of new fungi and bacteria for CNPSD)
- (b) Dr. Stahl, K.H., of Puls-fog machinery Co., West Germany (supply on loan of machines for testing by CNPSD).
- (c) Dr. Blencowe, J.W., Oxford, England, FAO/UN Consultant for rubber
- (d) Dr. Yee, Y.L., of Australian Agricultural Consulting and Management, Adelaide, Australia (possible supply of oil palm seeds to Brazil).
- (e) Mr. Hew, C.K., of PLANTEX Plantation Agric. Services, Kuala Lumpur, Malaysia (supply of oil palm seeds).
- (f) Dr. Abdul Aziz, S.A.K., Deputy Director, (Res) RRIM (disease control in general) and Mr. Teoh, C.H., Deputy Director, Prang Besar Research Station, Kajang (Prang Besar Clones), all of Malaysia.

5.22. Training & Seminars

In the course of planning and executing the various research projects in the lab and field at CNPSD and its other units outside Manaus, the local counterparts and their associated staff were shown and trained in methodologies developed in Malaysia and elsewhere in the formulation and conduct of experiments, including data collection, their storage, treatment and analysis. These exercises were held in the lab, field or during meeting and seminar sessions with the local counterparts.

The training initiated is a continuous process, particularly that pertaining to treatment and analysis of field data which await collection and success of trials. Briefly, demonstration and training relating to the following subjects were given:

- (a) Methods for leaf disease evaluation in the lab and field in terms of severity and incidence (for *Microcyclus*, *Thanatephorus*, *Phytophthora* and *Catacauma*).
- (b) Improved techniques in conducting thermal fogging trials for leaf disease control with Leco and Puls-fog machines, including disease assessment, leaf disease score and leaf fall counts, canopy density evaluation and yield recording of trees.
- (c) Methods in leaf disease assessment (including new disease keys) for differentiating clonal susceptibility in nursery and field screening trials.
- (d) Methods in data collection in field, preliminary treatment and analysis to establish micro-climate/disease relationships for disease forecasting in weather/host/disease studies (SALB and *Phytophthora*).
- (e) Orientation towards a leaf disease fungicidal control system integrated with use of extra manuring and better weed control for the Amazonia.

Apart from imparting the above proven methodologies to local counterparts to improve their research, the overall philosophy of my 2-year consultancy in Brazil is to evolve a better leaf disease control or management system. This system could be formulated only basing on an appropriate research programme that work towards it. In fact, lack of this has let SALB had its free reign for so long, thereby delaying for nearly a century the satisfactory domestication of *H.brasiliensis* in Brazil (Lim *et al*, 1984; Albuquerque *et al*, 1984).

Because SALB still presents a serious problem and newer leaf diseases are appearing at the same time, it becomes imperative that the relatively young team of local pathologists be trained in a rapid evaluation of field situations and fully appreciate their existing and potential disease problems. Projects are then formulated and the established and new techniques from elsewhere applied, wherever possible, to speed up research in resolving the same. In an applied research centre like CNPSD, researchers should preferably be problem-orientated and pragmatic in approach to their research programme. While pursuing different specialised areas of work, they should be led to see problems and the proposed solutions in an overall context. Two good examples of this promising new approach realised during 1984 is the work reported by Gasparotto *et al*, 1984 on an integrated approach towards SALB control in the Amazonia and that of Albuquerque *et al*, 1984, all involving a multi-disciplinary team-work. The first tapped the essential services of the State EMATER extensionists and an economist while the

second, the expertise of an experienced agriculture engineer from IAC, São Paulo.

By necessity, most of my local counterparts are spread out in the other States (Appendix 1). Currently, 2 in Acre and Rondonia are working in a rather remote or isolated situation, 3 in south Bahia not fully orientated to the State's grave leaf disease problem on account of the local Head of their pathology unit while the 1 most experienced in São Paulo is still to work in full unison with CNPSD. Obviously, this requires attention in 1985. Despite this, it is gratifying to place on record, the excellent efforts and positive responses in work by Gasparotto, L. & Albuquerque, P.E.P. at CNPSD, AM, Stein, R. at Convênio FCAF/EMBRAPA, PA and Pereira, J.C. and Santos, A. at Convênio CEPLAC/EMBRAPA, BA, in the building up of a cohesive and pragmatic team of plant pathologists to serve the rapidly growing new Brazilian NR industry.

5.23. Transfer of Technology and Extension

In response to periodic requests by rubber implementation or advisory agencies, plantation owners or EMBRAPA researchers, several visits or meetings to identify, evaluate and recommend remedial measures against diseases were made during the period.

The subject invariably touched on disease control research and its latest findings and how all these could be best adopted for use by extensionists, implementors of planting projects and planters. The following details were recorded:

(1) With SUDHEVEA

- (a) 30 May 1984, discussing leaf disease control strategies for Amazonia with A.R. Souza of SUDHEVEA, Olinto, G. & Gasparotto, L. at CNPSD.
- (b) 2 June 1984, field visit to Viçosa plantation, Manaus, to evaluate experiment on fogging, with A.M. Souza of SUDHEVEA and 3 French IRCA scientists.
- (c) 19 July 1984, to review results of thermal fogging projects 1984 in Manaus and Rondonia, with Orivaldo A.A. (Chief) & A.R. Souza of Agriculture Technology Department, SUDHEVEA, Brasília.
- (d) 20 July 1984, with Souza, A.R. and Subramanian, S. of SUDHEVEA, Drs. Abreu of CEPLAC, Chee, K.H. of RRIM and Gasparotto, L., as members of Organizing Committee, to plan the proposed International SALB Workshop to be held at CEPLAC in late August, 1984.

- (e) 24 July 1984, discussing on leaf disease control in general, with A.M.G. Castro, Chief of Planning Dept., Souza, A.R., & S.Subramanian, IICA/SUDHEVEA Consultant, & a World Bank rubber loan Consultant, in Manaus.
- (f) 29 & 30 June 1985, discussing the proposed "PROMASE NORTH" rubber rehabilitation projects with Dr. Orivaldo, A.A. (Chief), Dr. Bernado, B. & Dr. Cyro, P.R. of Agricultural Technology Dept. of SUDHEVEA, Brasília.

(2) Visits to Plantations

- (a) Belém, Pará, June 1984, to evaluate leaf disease problems. With Silva H.M., Pinheiro E., Ruth B., and Nunes M.A.L., meeting planters B. Avery Jones, Lion A., and Francisco A.Chagas.
- (b) São Paulo, July 1984, to assess leaf disease problems. With Rosa Maria, C., Domingo, A.Z.; Marly S., and Edson, F. of IB & met planters Carlos A. Ostenbland, Niggo R., Ussaki Jorge and Maximo, Y.
- (c) Agricultural District (SUFRAMA) Manaus, AM (a) 13,20 & 22 November & 1 December 1984, & 12 March 1985, to assess disease problems & recommend control on Fazendas Viçosa, Montebor, Triângulo & Agrocín with Gasparotto, L. & Jomar, P, Dr. Junqueira, N.

(b) 17-20 December 1984, to assess all aspects of problems on the State PROBOR III 40 planting projects, as a member of a multi-disciplinary team from CNPSD and representatives fo SUDHEVEA and EMATER, Amazonas.

(3) Seminars to Planters/Extensionists/Researchers

- (a) Manaus, 18 December, 1984 giving a talk on "Leaf disease problems on PROBOR I-III plantings in Amazonia and their control" to members of Planters' Association and officers of SUDHEVEA and EMATER in Manaus.
- (b) University of São Paulo at Piracicaba, 3 June 1985. "A suggested leaf disease control or management system against leaf diseases on *Hevea*", to professors and 25 post-graduate students on phytopathology.

(4) Other Advisory Contacts

Discussions were held on disease problems with the following extension people:

Marcelo, D.A.G. of EMBRATER, Brasília, Dr. Cyro, P.R., and Dr. Bernado, B. of SUDHEVEA, Brasília, Jordão, F.O., of R. Gerson S. EMATER, Itacoatiara, Ézio, B. & Yara of SUDHEVEA, Manaus & Conduru, J.M.H., of SUDHEVEA, Belém.

In the transfer of technology, the remoteness of Amazonia its great distance from conventional sources of supply of protectant chemicals in São Paulo pose a severe constraint. Although tentatively recommended, the fungicides SaproI and Bravonil are difficult to buy or are prohibitively costly in most parts of Amazonia for use against SALB and *Colletotrichum*. The same applies to equipment especially routine services and spares, eg Puls-fog K20/0 now recommended for use based on 1984 results, besides the portable mist-blower.

Even in area of research, few technical or project personnel of agrochemical firms visit Amazonia often to fully appreciate the serious problems of leaf diseases. They are therefore unable to be on-the-spot regularly to assist researchers in the supply of new chemicals for testing or their field development for rapid use by planters.

This has to be improved somehow and CNPSD captures their attention, as is the case enjoyed by researchers in the central or southern parts of Brazil.

5.24 Reporting and Result Presentation

Early data tabulation and analysis, followed by timely publication of results of research, ensure their speedy dissemination and adoption by the planters. Thus, local counterparts were encouraged to do this during 1984.

This has included the compilation of reviews (Lim *et al*, 1984; Albuquerque *et al*. 1984; Gasparotto & Lim, 1984) essential for enhancing research directions, progress reports on a specific trial or project (Lim, 1984; Pereira *et al*, 1984), technical papers on an important topic and advisory articles (Gasparotto *et al*, 1984) to facilitate technology transfer.

Thus, including those already cited in this report, with me as author or co-author, the following numbers of different publications were produced on leaf diseases and their control:

(a) Technical reports

9

(b) Technical papers

30 of which 14 are full-length papers published or submitted for printing, with the rest as abstracts presented at conferences & congresses in Brazil.

(c) Extension articles

One submitted for publication, and 2 as extension reports after plantation visits.

Compared with previous years, the above represents a record number of publications on leaf diseases alone compiled by my counterpart pathologists and application technologists currently serving CNPSD and its co-operating units.

ACKNOWLEDGEMENTS

It is always a pleasure to put on record my indebtedness to numerous people for assistance, hospitality, interest and collaboration in this work within and outside CNPSD, Manaus. Space, however, permits me to mention only Drs. Valois, A.C.C., Paiva, J. R., Celestino Filho, P., Imar, C.A., Olinto, G. and Tomaz, A., all of the Directorate, CNPSD.

My helpful local counterparts, Drs. Gasparotto, L., Silva, H.M. & Albuquerque, P.E.P. and the others space not permitting mentioning in Para, Rondonia, Acre, south Bahia and São Paulo, are also thanked. Thanks are also due to Drs. José Carlos Nascimento, EMBRAPA, Brasília, José Cezário, M.B., Antonio Maria, G.C. and Souza, A.R. of SUDHEVEA, Brasília, Rocha, H.M. of CENARGEN, Brasília, Prof. Bergamin, A. of Piracicaba, Prof. Pinheiro, E. of FCAP, Pa, and Dr. Ortolani, A. of IAC, for helpful discussions.

For advices and the excellent facilities provided to enable me to carry out the assigned duties at CNPSD, I also thank Drs. Scarsi, J.C., Gustalfson, D. and Wagner, E. of IICA, Brasília.

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APPENDIX 1

List of Local Pathologist Counterparts with Details on
Location and Project, 1984/85

Name	Research Unit/Location	Research Activity Code
) Gasparotto, L. M.Sc. (3 years)		5.11, 5.13, 5.14
) Silva, H.M. e M.Sc. (> 5 years)	CNPSD, Manaus-AM	5.11, 5.12, 5.14
) Albuquerque, P.E.P. M.Sc. *(2 years)		5.13
) Stein, R.L.B. B.Sc. (2 years)	Convênio FCAP/EMBRAPA, PA.	5.12, 5.13
) Nunes, M.A.L. M.Sc. (< 1 year)	FCAP, PA	5.13,
) Santos, A.F. dos M.Sc. (2 years)	Convênio CEPLAC/EMBRAPA, BA	5.13
) Pereira, J.C.R. M.Sc. (3 years)	Convênio CEPLAC/EMBRAPA, BA	5.13
) Almeida, L.C.C. de. M.Sc. (2 years)	CEPLAC, BA	5.12
) Pereira, L. M.Sc. (< 1 year)	UEPAE-Rio Branco, AC	5.13
) Moreira, M.I.P. M.Sc. (2 years)	UEPAE-Porto Velho, RO	5.12
) Rosa Maria, C. M.Sc. (> 8 years)	IB, São Paulo	5.12
) Corrêa, H.G. M.Sc.* (Agric.engineer) On secondment to EMBRAPA.	IAC, São Paulo	5.13

.years): Years of research experience on *Hevea* diseases.

* : Agriculture engineer