PROJECT PPW-LTA77-CANARD/a:
SMALL HOLDERS COFFEE DEVELOPMENT
in
Aceh Tengah

ARABICA COFFEE IN ACEH TENGAH

Consultant Report on
Applied Arabica Coffee Research
May 1985 - June 1989
(Unedited Version)

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Pondok Gajah, June 1989

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Presentation.

The Aceh Tengah Small Holders Coffee Development Project is being carried out in the framework of the 'Central and North Aceh Rural Development Project', which is known under its reference PPW-LTA77/K12. The author of this Report, Eng. H. Renes, has been assigned as an agronomist to this project for Aceh Tengah from February 1985 until the end of June 1989. This is his Final Report.
The Report is dealing with technical aspects of Arabica Coffee growing in Aceh Tengah, i.e. descriptions, findings and recommendations on a number of subjects. These are judged to be relevant and valuable for both on-going applied research activities and, even more so, for agricultural extension.
The Report suggests the need for on-going arabica coffee research in Aceh Tengah. However, no recommendation as to the specifics of such research programme is given.

The extent, the encouraging potential but also the complexity of arabica coffee production in Aceh Tengah, which could be appreciated during the past years and which are hoped to become more transparent in this Report, are believed to justify the recommendation as to the continuation and the institutionalisation of some sort of arabica coffee research in Aceh Tengah. Indeed, approximately 75% of all arabica coffee grown in Indonesia is located in Aceh Tengah, representing at least 28.000 ha of joined coffee gardens.
During the past years, it has been demonstrated that, if properly processed, the Aceh Tengah arabica coffee meets with encouraging demands in the international market. A case in point is 'Gayo Mountain Coffee', which is yielding premiums of more than 50% above the NY-C price for mild arabicas. Notably Japan and Switzerland have come to appreciate this coffee for its bean- and liquor qualities of good taste and flavour.
During the same period, progress was registered in terms of collecting promising catimor lines and others from various coffee research institutes in the world and of developing them in observation gardens. The expectations are high that at least some of these lines will yield good quality, leaf-rust resistant and high-yielding arabica coffees suitable to be grown in Aceh Tengah. It is no longer unrealistic to expect that the arabica coffee yield per hectare can at least be doubled in the future, provided the needed research services be continuously granted to the area and be institionalized so as to be vested with adequate authority to conduct the needed research activities and with proper leverage to control and to coordinate the introduction of new varieties among the Aceh Tengah coffee growers in a responsible and effective way during the next decade or so. The expected benefit is more than encouraging, ultimately reaching at least some 15.000 tons of additional arabica coffee production per year, the value of which can be estimated a conservative US# 30 million per year.
Such are the contours of what can be done and of what should be done.

At the present junction of arabica coffee growing promotion in Aceh Tengah, the important question to be answered and to be translated into a programme of action can be worded as follows: How to assist the farmers in the rejuvenation of their coffee gardens so as to assure the highest possible degree of sustainable success? This is definitely calling for the provision of effective extension services. This is also calling for adequate coffee research to be programmed and implemented so as to respond to the farmers' needs and ambitions, including such aspects as coffee farming techniques and farming systems evolving beyond the mono-culture of arabica coffee.
When the LTA77 Project started, except the farmers and some specialists one was not aware of the importance of arabica coffee growing in Aceh Tengah. Coffee from this area was exported under such other names as Sidikalang or Mandheling or just as bulk coffee. At present, Aceh Tengah coffee is known under denominations that are directly linked to the area. In terms of knowledge of this coffee, the situation has drastically changed from zero to an impressive data base, of which the present report is a summary. Now it should be undertaken to make the point and to decide in which way this data base should be kept up-to-date and expanded so as to be and to remain an important tool in the rejuvenation of the farmers' coffee gardens in a responsible and effective way. May this Report become one of the references that will be used in the decision making process.

If is felt that the Report could and should be worded more carefully and in better english, so that it may address a larger public. Hence, this edition is presented as a non-edited version at the destination of the technicians and the policy making instances involved in the shaping of the future of arabica coffee research in Aceh Tengah. The edited version is hoped to be presented in the near future.

Banda Aceh, 9-10-1989

A.Heijboer
Teamleader Project LTA77

INTRODUCTION

At the end of Authors' assignment as agronomist of the Aceh Tengah Coffee Development Project, which lasted from April 1985 till the end of June 1989, it seems justified to submit a final report including recommendations to all persons involved in the activities of this Project and to those who will be in the future.
It is his hope that International Arabica Coffee Institutions, which were contacted during his assignment, will appreciate the fruits of his efforts to unveil the typical constraints one meets in Arabica Coffee Research.

Aceh Tengah with approximately 75% (representing 28.000 ha joined coffee-gardens) of the total Coffee Arabica production of Indonesia, deserves the foundation of an Arabica Coffee Research Station, the more so since during the period of Authors' assignment successful international marketing took place of Arabica Coffee,which under the name of Gayo Mountain Coffee found its way to Japan, Switzerland and other countries. The coffee is generally accepted as an excellent Arabica Coffee that has positioned itself in the international conception of preferences concerning taste and flavour. The coffee reaches the high demands of bean- and liquorquality comparable to those elsewhere.

The Author's share in the marketing by contacting reputed roasters in Europe increased his anxiety to stabilize a production of Arabica Coffee in Aceh Tengah of constant quality according to the conditions of interest of the international buyers.

As will be seen in this report, the complexity of factors in relation with the problematical conditions of Arabica Coffee growing in Aceh Tengah required immediate action. A modest applied research programme was initiated, including the training of Indonesian Staff.
In view of the foundation of an Agro Research Station the training of Staff should have been optimal. However, limitations such as unforseen difficulties in recruiting qualified technicians, hampered the execution of the trainingprogramme.

The results of the applied researchprogramme, however, give reasons to believe that recommendations will be released concerning a variety with a potential high yielding and sustained production of good quality coffee and

probable Leaf Rust resistant.

The Author is aware of the fact that an eventual increase of production per hectare should always be related to a parallel development of marketing the product. He recommends the Agro Research Section of the Project to exercise great care and to maintain close relations with the market characteristics as exist in Aceh Tengah.

He regrets it very much that the realization of an Agro Research Station in Aceh Tengah could not take place during his assignment, at the same time expecting that the dedication of the Staff will make a positive implementation of the programme not only possible but also successful.

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History

Arabica coffee was introduced in Indonesia (Java) in 1696, and became the most important commodity to the Dutch Government until the end of the 19th century (Cramer 1919). It had a good reputation on the world-market as "Java coffee".
By 1885 Indonesia was producing over 60.000 tons of coffee a year (de Graaff 1986), and was the second largest producer in the world after Brazil.

Then, in 1878, the coffee leaf rust (CLR) attacked the plantations and most of the coffee arabica on lower altitudes was replaced with CLR-resistant coffee robusta.
Nowadays Indonesia is the second largest producer of the inferior robusta coffee. The national production consists of 92% robusta, 6 % arabica and 2% others.

The arabica mostly grows in the highlands of which two third is grown in Aceh Tengah.
However, the first plantations in Aceh were established in 1924 (Paya Tumpi and Meerzicht) after the road Bireun-Takengon was finished in 1913. The expansion of the coffee area was progressing very slowly because of the isolated location and high transport costs.
Initial plans to start tea plantations and built factories were hampered because of the depression of the 1930's and more coffee was planted instead (Frieling 1984).

The areas of concentration were between Timang Gajah and Lampahan, around Takengon up to Burni Bius and around Redelong (Bandar).

After 1930 coffee became important for the smallholders as cashcrop, and after the 2nd world war all coffee was produced by smallholders only.

Location and general description of the coffee area in Aceh Tengah

The smallholders coffee areas in the highlands of Aceh Tengah are located mainly South-East, South and South-West of the footslopes of Mount Geureundong up to the mountainrange North of Lake Tawar and the line from Takengon (capital of the district) to Angkup, the main river Peusangan forming more or less the borderline on the West-side.

The total area is estimated on 32.750 ha., representing 85% arabica and 15% robusta. (Dinas Perkebunan 1988)

From the 9 sub-districts (kecamatan), Bandar has the largest area under coffee with more than 13.000 ha. (40%). In the sub-districts the rate and speed of expansion is increasing considerably.

Most of the area under arabica coffee is found on altitudes ranging from 1250-1500 meter a.s.l. Most robusta is found below 1000 meter a.s.l.

The landforms range between hilly to mountainous where flat areas occur in valleys (Takengon and Simpang Tiga) along major rivers and estuaries South of Lake Tawar. Most of the flat areas have been brought under sawah rice cultivation.

The district of Aceh Tengah depends heavily upon agriculture for the livelihood of its population. The majority of the population is directly involved in coffeeproduction. Off-farm employees often possess a coffeegarden.
Coffee estates are not present and cultivation of coffee is carried out by smallholders only.
The existing farmingsystems consist of a combination of subsistance ricefarming (sawah) with perennial cashcrops of mainly coffee mixed with other perennial treecrops and annual cashcrops such as sugarcane, tabaco, nilam, potatoes and vegetables (ladang). Other perennial treecrops consist of fruittrees such as banana, jackfruit, avocado, and industrial treecrops such as cloves and cinnamon.

The coffeecultivation is extensive with estimated average yields of 500kg/ha., which can be considered as a moderate to high yield for the traditional level of inputs.

The sustainability of these yields over the past years of old coffee is due to the fact that the first coffeeplantations have been planted on the best agricultural soils (deep volcanic soils of good fertility, high organic mattercontent and good structure).
The more recent coffeeplantings are found on more marginal land (shallow topsoil with presence of hard pans, slopy land and/or low fertility)

The presence of Coffee Leaf Rust (CLR)* is obvious and outbreaks are severe on lower altitudes. This disease is generally considered as a natural feature for arabica coffee, as it was most probably present from the beginning of the coffeeculture in Aceh Tengah.
This opinion and absence of coffeeresearch are reasons why Coffee Leaf Rust has been underestimated in the past.

Since 1986 heavy outbreaks of the Jumping lice*, which defoliates the Lamtoro shadetrees several times a year for long periods, occur.
This pest and the coffee rust are going to endanger the coffee arabica culture in Aceh Tengah.

* see chapter "Pest & diseases.

Climate

Rainfall

The rainfall in Aceh Tengah shows quite a diversity in the total annual precipitation at different locations and altitudes. It varies between 1731 mm (Takengon) and 3103 mm (Blang Rakal). Monthly precipitation differs largely each year.
These totals lie within the range of 1500-2500 mm which is preferable for coffee.

The average figures show 9 wet months from September till June, ranging between 175-225 mm/month, with a decline during February with a range of 125-175 mm per month.

The main dry period of 3 months is generally in June-July-Agust in which the rainfall is still more than 50 mm/month with an average number of days with rain ranging between 5 to 10 days.
These relatively dry months may not be dry enough for coffee to allow a period of complete dormancy and the trees are in a permanent state of shootflush. No distinct major flowering does occur as a period of moisture stress is lacking and a semi-permanent cropbearing is observed, reason why the harvest period may last up to 8 @ 9 months.

Temperatures

The mean monthly variation in temperature is small and averages for Takangon (1200 m a.s.l.) are max. 27.2° C, min. 15.2° C and average 20.6° C. Considerable daily fluctuations of 11-13° C are measured.

If calculated with an approx. ½° C decrease in temperature upon 100 meter increase in elevation the averages for Pondok Gajah (1400 m a.s.l.) would be max. 26.2° C, min 14.2° C and average 19.6° C.

The optimum temperature range for coffee arabica is considered to be 15-24° C. At temperatures above 25° C photosynthesis is reduced and above 30° C leafdamage may occur if continuously exposed.
CLR damage becomes more severe with increasing temperatures. Cold damage has been observed sporadically and hail damage does not occur in Aceh Tengah.

Meteo station

Since 1986 meteorological data were collected from a medium-size station, set-up by the Agronomy Section, at the Project compound.

A local made Stevenson shelter with a max/min thermometerset, a hygro-thermometer and a weekly recording hygrothermograph supplied data about temperture and humidity.
A local raingauge supplied data about precipitation; a Cambell Stokes sunshine recorder supplied daily numbers of sun-hours or % of 12 hours measurements and a Cap anemometer gave the daily wind velocity in meters per second.

The Meteorological Department in Medan has checked the installation and now supervises the data collection on a monthly basis.

The whole station had to be moved to another nearby location as the factory needed more space to add drying tables.

Soils and land evaluation

The coffee area consists mainly of vulcanic soils developed on ash deposits and lahars (mudflows), which are described in detail, including other matters concerning land suitability evaluation, in the following reports :

- A soil fertility appraisal for preliminary fertilizer recommendation by R.A. Leyder (1981)
- A land evaluation survey by P. Buurman (1981)
- A land evaluation for agricultural use of Aceh Utara and Aceh Tengah by P. Buurman and J.H. de Vos (I.T.C. 1984)

For the coffee cultivation the first two reports are of interest whereas the latter report is more considered as a tool for policymakers and planners because of its reconnaissance and semi-detailed nature.

As most maps available are of minor quality and of different scales it was thought to make a set of transparents of the same scale (1 : 50.000) of topographical maps (1978), indicating altitude classes, slope steepness classes, prevailing soil classes/landform classes and suitability classes for coffee arabica. This set (not yet completed) will facilitate location and evaluation in more detail.

For Phase II the project will deal with the whole of Aceh Tengah and the above mentioned set will be of utmost importance for the division of the coffe area in various zones for more specific recommendations and for regional planning.

Supporting services to coffee growers

In 1976 a Coffee Project was started, carried out by the Dinas Perkebunan, with the objectives of increasing the income of coffee growers through improvement of the production and quality.
It is assumed that before this project no real support was rendered towards coffee growers in Aceh Tengah by Government services.

For this project the Dinas Perkebunan, a Governmental agricultural extension service for estate crops, was reinforced and they put up special units UPP.PK (Unit Pelaksana Proyek = Project Management Unit), which were commissioned solely to work for this project.
Ten (10) Units have been established in all Kecamatan Subdistricts except Linge.

The main tasks of these UPP.PK were :

1. to advise and demonstrate to the farmer improved systems of pruning (hereafter refered to as UPP.PK system)
2. to advise and demonstrate to the farmers the use of chemical fertilizers
3. to advise on means and advantages to be gained from obtaining credits
4. to actually give credits
5. to put up selected seed nurseries
6. to introduce and distribute new selected seedlings.

Except common problems and constraints such as insufficient organizational support and backstopping, lack of funds and transport, the above mentioned tasks will be discussed and commented on later in this report, some results being positive, some contradictious and even negative as far as quality is concerned.

In 1985 plans to create a Plant Protection Unit were made.
A country-wide project by the Directorate General of Estate Crops, assisted by the Asian Development Bank (see progress report April-

December 1985, page 19). Land to build an office was made available by the LTA77/a project on the compound. The building was finished by the end of 1986.

Since then no action was taken.

The main problem of the coffee industry in Aceh Tengah

The importance of coffee for the economy of most producing countries in terms of foreign exchange earnings and taxation is to some extend reflected in the extent of services to producers. (de Graaf 1986) These are generally official bodies functioning under a coffee act and placed under the Ministry of Agriculture or another ministry. They are often responsible for production, trade policy and programmes and have wide powers in implementation.
Emphasis is usually on provision of technical assistance (extension), research, credit for growers, price stabilisation, price support, marketing and quality control.

In Indonesia however, whereas coffee is predominantly produced by smallholders, the marketing is entirely in the hands of private traders and exporters with the Government exercising a supervisory role only.
The Directorate General of Estate Crops of the Department of Agriculture is responsible for planning, research and extension services within the coffee sector.
The Directorate General for Foreign Trade, within the Department of Trade and Cooperatives is responsible for quality control, testing and supervision of coffee exports.

Because of complaints about insufficient quality - wet coffee and deliberate mixing, supposedly by middlemen and the lack of adequate control measures - the reputation of Indonesian coffee abroad was affected.

In 1979 the Association of Indonesian Coffee Exporters, was established. It aims at closer cooperation between trading parties and at improving quality and trade practices.

The Jember Research Station for Estate Crops (East Java) is engaged in coffee research and is of course paying more attention to Robusta rather than to Arabica.

However all the above mentioned institutes paid little attention to the Aceh Tengah coffee area although the largest producer of arabica coffee

of Indonesia.
The irony of it is that even the small efforts to increase production and quality through the UPP-programme had an adverse effect on quality because of wrong varieties chosen.
It was proven that the local arabica variety, provided it is processed in a proper way, can fetch premium prices comparable to the Jamaica Blue Mountain.

One would say it is about high time that Aceh Tengah creates its own Coffee Board and the PNG system could serve as an example

Basicly the PNG Coffee Industry Board finances itself, Research and Extension by means of a levy of 8% of the export coffee prices, of which 2% are renumerated to the Board itself, 3% to Research and 3% to Extension.
The Board consists of coffee growers for 80%.
A very important point for such a Coffee Board is the power to implement programmes and the means to prosecute in case certain rules are broken.

If such an official body is absent all future crash programmes are bound to crash.

COFFEE ARABICA PEST & DISEASE AND THEIR CONTROL

In 1981 a IDAP* - short term consultancy was carried out by a junior expert in coffee agronomy (Schuiling 1982).
The report of this study is available in the University library, Wageningen but apparently still not found yet in Aceh.
In 1985 one photo copy of the draft report was made available to the Project.
A large part of this report is concerned with the occurence of C. Arabica and robusta pests and diseases and control.

A baseline survey about coffee pests and diseases in Aceh Tengah was planned since 1986 in collaboration with the ADB/Dinas Perkebunan, plant Protection unit programme.
The agronomy section facing a shortage of trained staff to carry out the programme is still awaiting the team of this unit.

The occuring pest and diseases observed sofar are summarised in a revised table (see annex). The information is based on the above mentioned report and further added with data based on observations during visits to farmers fields and the LTA experiments.
The degree of affection are rough estimations whereas the degree of damage and necessity of control are more certain.

Diseases:

Arabica is far more susceptible to diseases than robusta coffee. The most common and dangerous disease is Coffee Leaf Rust.
Less common but even so dangerous for the future are the Root rot diseases as the spread is encouraged by the small holders themselves.
Overbearing and Die-back, a physiological disease is becoming more and more serious because of the out breaks of Jumping lice.

Coffee Leaf Rust (CLR)

This leaf disease is caused by the fungus Hemileia Vastatix and can be easily recognised by the orange powdery spots (lesions) on the under-surface of the leaves. The spread of spores produced from the lesions is by wind, rain and carrier. Infection can only take place in the presence of water and is therefor confined to the rainy season.

* IDAP = Institutional Development Assistance Project, Banda Aceh.

As incubation time is temperature dependant (2 weeks in hot-and up to 6 weeks in cold conditions) the disease builds up very rapidly in warmer areas than for instance areas of higher altitudes where cold conditions prevail.
Diseased leaves are shed prematurely disturbing the leaf-fruit ratio .

CLR is a classic among plant diseases. Worldwide spread started from Ceylon, where it destroyed the whole coffee industry between 1860-1880, to Indonesia in 1878 where most C. Arabica was replanted with C. canephora.
It then spread accross Asia to the Pasific Islands and accross Africa to Brazil in 1970 from where it spread to all coffee growing countries in Latin America.
As Portugal had interests in several coffee producing countries, a research programme to differantiate races of the pathogene and screening of coffee plants for CLR resistance was initiated as chemical control was unsatisfactory sofar.
No coffee is grown in Portugal and thus it became an ideal centre for international CLR research.
In 1955 the Centre for rust Research (CIFC) was established. Further research work on screening and differentiating rust races was conducted. With hundreds of rust samples from many coffee regions in the world and a very large collection of germplasma, 32 races of the fungus have been differentiated.
The CIFC discovered the potential of Hibrido de Timor as a progenitor for durable rust resistence. Breeders have placed their hope in the near complete resistence to all known races of the HDT genotypes CIFC 832/1 and CIFC 1334/269. Breeding programmes in cooperation with various coffee research institutes were based on crossing between the dwarf type cattura and H.D.T. = Catimor.
Advanced generations are now available and in some countries Catimor-lines are already used as a commercial cultivar.
In Aceh Tengah Rust is common in the entire coffee area. It is even so that the coffee small holders consider the disease as a common feature.
Most probably rust was introduced at the same time coffee production started in Aceh Tengah.
The damage by CLR has been highly underestimated in the past by the supporting services. Attempts to control CLR was never undertaken.

The Director of the Jember Research Station DR.Ir. Soenaryo and Mr.J.op de Laack, coffee adviser of the coffee Project (HCRDC) in Thailand, who visited the LTA 77/a Project from 1-8 May 1987 affirmed the above mentioned statement of underestimation of CLR damage.
Heavy outbreaks of CLR, even at higher altitudes have been observed.
The attacked trees showing premature leaf drop, the process often accelerated by the "depic" storms. The susceptible cultivars, if not in optimum condition suffer subsequently from overbearing and Die-back.
Biennial bearing of the coffee in Aceh Tengah is a common feature and it is believed that CLR is one of the major causes.
At lower altitudes most arabica cvs are replaced by robusta and interspecific hybrids because of the increasing damage of rust.
Even the latter are attacked and outbreaks become more frequent.

Control

Cultivation measures

Improved cultural methods with emphasis on prunning and weeding create improved growing conditions and thus health of the coffee. A better light penetration and aircirculation will reduce the change of infection for the CLR-susceptible local cultivars.
However, it is assumed that high costs involved in labour intensive inputs will not justify the increase in production. The majority of coffee farmers grow their coffee in an extensive way with minimum inputs and this habit will not change in the near future.
It would be regrettable if the cultivar bergendal is going to disappear in future because it is still a question wether the new introduced coffee lines retain the characteristic of "Gayo-quality". It is thereby recommended to start a research programme with the aim to safeguard the existence of the B&D-coffee on the best soil and altitudes by improved cultural methods combined with chemical control.
The chemical control however preferably through soil application rather than spraying.

The second option of course is the introduction of CLR-resistant-varieties as far as short term plans are concerned. For long term planning back crossing with the catimor might be a solution.

Root rot

In old shaded coffee, root diseases are very common.
The causes are various and sofar a proper identification has not been made.
Three main fungus root diseases have been identified in the past by Schuiling.
Damage to coffee is fatal to coffee and the shade trees lamtoro.
The pathogene becomes identifiable underground only. Above the ground the symptoms are very similar.
Sudden wilting of the leaves followed by chlorosis are the first symptoms.
The leaves turn yellow and die off, after which leaf drops, die-back of twigs and later of branches occur. Finally the entire tree dies off.
In most cases farmers in Aceh Tengah replant before or immediately after uprooting of the dying-off dead coffee trees. The same applies to lamtoro.
The young plants will be infected and die sooner or later. The disease occurs generally on a single tree and then spreads slowly towards the adjacent trees.
In case of the Black root rot (Rossellinia buonodes) and Brown root rot (Fomes noxius) the lamtoro tree is the initial source from where surrounding coffee-and lamtoro trees are infected.
On land recently cleared of forest or of old coffee and lamtoro trees, the newly planted coffee and shade trees are liable to become infected by the pathogene Armillaria mellea. The spread of this root disease is caused when land is not properly cleared. The remaining stumps and roots are the sources of infection as the root fungi cannot live for long in soil only.
The coffee in the transmigration Project Jagung (Kecamatan Linge) is seriously infected by these spreading fungi. Land preparation in this area consisted of cutting and burning only.

Control

Very little can be done to save trees infected by root rot. Prevention is crucial. All stumps and roots should be removed and burned after land clearing to deprive the parasitic fungi of food supplies. Land clearing through ring barking is very time consuming as well as leaving land fallow for at least two years. However the system is effective !

Coffee trees (or lamtoro) showing the first symtoms should be immediately uprooted thouroughly and burned on the spot. Trees infected for a longer period might have spead the disease and the neighbouring trees should be uprooted and burned as well. To avoid further spead a deep trench should be dug around the spot and left fallow for at least 2 years.

In a corner of field VIII an outbreak of probably fusarium occured. Part of the backcross Catimor/SL 28 = H 306/1, had to be uprooted and destroyed.
The cause is believed to be the wastewater disposal of the Project processing unit. In 1987 this wastewater, poluted wich fermentation water and coffee mucilage (high % of sugar) was allowed to run into the field for a couple of months until the wastewater disposal problem was solved.
After many signs of infection were observed a deep trench was dug. Further spread is avoided by chemical weed control and slashing only. In case light hoeing is necessary, special care should be taken to avoid soil traffic to neighbouring fields, by clearing and desinfection of tools and rubber boots used.

If intercropping is considered, crops belonging to the family solanaceae like potato, tomato, chilly, tobacco and eggplant should be avoided.
The crops increase incidence of fungi and nematodes.

Damage by nematodes should be carefully studied in future as very little is know about it.

PESTS

Scales

The brown scale (Saissetia coffee) is more common than the green scale (Coccus viridis) and mealy bug (Planococcus citri).
Young and unhealthy coffee suffers most from the scales. The brown scale are rather immobile insects, greenish when young and dark brown when older. They are mostly clustered on shoots but leaves and green berries are affected as well.
They are often found together with green scale and mealy bug.
The damage of the scales is cummulative and causes considerable damage to young coffee in the first place.

The scales obtain their nourishment by puncturing the young plant tissue and extract the sap.
They multiply rapidly in dry weather but their number tend to decline in long raining periods.

Association with ants

Various species of ants attend the scales on the host plant. The ants are attracted to the scales because of the honey-dew produced. By means of their antenna the ants "milk" the scales to obtain the honey dew.
Ants also increase scale population by spreading and protecting the scales.

Control

The control of scales should be geared towards breaking the link between the ant and the scale either to prevent the ants climbing into the coffee tree by "banding" and pruning back the laterals touching the soil or by destroying the ant nests.
Banding should be tried with the combination of material treated with greace or oil and contact insecticides or by painting lime mixed with sticker and insecticides.
Ant traps with bambu are explained in the report of Schulink and are recommended to reduce ant population in the coffee fields.

Spraying the scales with contact insecticides has little effect. Effects of systemic insecticides should be studied. Chemical control by soil application of granules consisting of systemic fungicides and insecticides are tried in Latin America with positive results.

Jumping lice (Heteropsylla spp)

Lamtoro shade tree (Leucaena lencocephala)

The lamtoro shade tree is a prennial, deep rooting, leguminous tree that maintains green small featherly leaves throughout the year. It is able to exploit soil moisture and nutrients at depth.
The tree has a wide range of adaptability tolerating great differences in rainfall and soils. On higher altitudes growth becomes slow and rather stunted.

The lamtoro builds up a high quantity of food reserves in the rooting system. In general it has few perts because of the pungent smell and taste of the leaves and it contains some toxic "menosine" content.

Outbreaks of Jumpinge lice and damage caused

Although lamtoro was known as a pest tolerant tree, the first alarming outbreaks of jumping lice were reported in the beginning of 1986 in Indonesia. The outbreaks are world wide starting from Hawaii.
In Aceh Tengah the lamtoro shade trees were attacked in August 1986. Within one month of time the whole area was affected leaving the lamtoro trees completely bare.
Contineously, outbreaks are observed and most damage occurs during the short dry periods. (See report Helmi AG 1988).
Besides the shadetree the coffee becomes endangered as well. The coffee tree exposed to sudden increase of light intensity reacts by increase of flowering and subsequent overproduction.
The dangers of overbearing and Die-back become higher. In case the outbreaks of jumping lice continue the coffee tree will finally use all its food reserves, even from its rooting system, and damage will be permanent.
See technical advisory circular : Overbearing and Die-back in relation to the outbreaks of jumping lice (H. Renes 1988).

Control

The control of the jumping lice is threefold and is based on an integrated approach. The programme of control is summuarised as follows:

- Chemical control by treatment of the Lamtoro trees with systemic insecticides, applied through the cambium layer of the tree which system does not endanger the predators already released.
- Biological control by reproduction of predators (Curinus coeruleus) and releasing the larva and adults in the field. In collaboration with the Dinas Perkebunan.
- Applying fertilizer to avoid Die-back or by partly stripping of the crop and planting temporary shade trees.
- Replacing the dead Lamtoro trees with either resistent Leucaena species or other shade trees. Gliridicae was found the best of the available alternatives.

ACTUAL AND FUTURE COFFEE VARIETIES IN ACEH TENGAH

General situation

In Aceh Tengah no official body exists to control coffeeseed production and distribution. Any person is in fact free to introduce any coffee variety of his preference.

As a consequence an unknown number of varieties have been brought into Aceh Tengah during the last decennias.

The most important spp. is C.arabica (80%) of the botanical variety Coffea arabica; syn var. typica and Abyssinian types.

Most of these varieties have been given local names such as Sidikalang, Rambung Bergendal and "kopi beras".

Other hybrids have been brought in by the Dinas Perkebunan like the "kopi Jember" (S288) and "Timtim" or Arabusta (Selection of Hibrido de Timor, Hdt).

In the coffeegardens the mutants Caturra and a Maragogipe type were found.

A new veriety or better Hybrid, "Kopi Ateng", was brought in accidentally some 8 years ago.

All varieties are mixed and scattered all over the coffee area.

Once the coffeetrees take the umbrella-shape, differences become obscure and determination is difficult.

No inventory was made according to the ecological zones concerning variety, age and yields.

Variety trials

The Project managed to obtain 19 varieties and lines at the end of 1984 through the PTP XXVI (Semi Government Estate for Coffee, Tea and Cocoa) and the Research Station for Estate Crops, Jember, East Java, with the aim to start the establishment of a collection orchard on the Project compound.
Provisional arrangements were also made by the Extension Section to distribute the remaining seedlings among the 10 UPP-PK's and selected "progressive" farmers, to assist the Project to evaluate the various varieties and lines.

Usually this should be done by research and only after selection of the most promising varieties and tested under farmers' conditions in the various zones or according to altitude classes.
As all varieties were old introductions to Indonesia and the UPP-PK's did not show interest to participate and no other land was available except 2 ha at the Project compound, it was decided to establish replications of the trial (Field I) on farmers' fields.
Selection of these farmers went haphazardly because of lack of extension staff and time, as seedlings became somewhat overaged.

Information about the varieties was not very clear, lacking quantitative data, especially the existing varieties from Aceh Tengah.
To make matters worse, it appeared later that seed was unpure and in some cases mixed as well.

At nursery stage the Caturra Red variety appeared to be a tall type and only 15% of the Caturra Yellow were real dwarf types.
At a later stage it was discovered that the Bourbon was not a Bourbon.
The moment these varieties started bearing, some trees of Caturra Yellow showed red berries as wel.

It goes without saying that this kind of discoveries makes one suspicious about the other varieties. The trial lost part of its value because of uncertainties about true sources and purity. On the other hand the collection became an interesting field for training and determination of varieties and demonstration of the Single Stem pruning system capped on 3 different heights.

Farmers lost interest because from all the varieties not a single one showed something special.
However the trials served their purpose. They would now be discontinued 6 out of 15 fields can be used for future training to extension agents.

Information about the 19 varieties is summarized as follows:

USDA 230762	origin: Ethiopian, parent material not know yet;
USDA 230765	tall type; green tip; uncomplete CLR-resistance;
USDA 230731	good yield potential expected; no data yet about beansize (acc. to Jember good) and cupquality.

All 3 lines are slow growers and are very susceptible to "hot and cold" and strong winds, but after the 2nd year they show better performance and promising yields, when soilconditions and maintenance are optimum. The USDA 230762 is used in East Java (PTP XXVI) on large scale for re-planting programmes.

S 288 or "Jember"	origin: Indian, interspecific hybrid, a selection from S 26 = C.liberica x C.arabica (natural cross). Tall type: bronze tip; quite small dark leaves. Uncomplete CLR-resistance. Introduced in Aceh Tengah approx. 10 years ago.
S 795 and 1934	Selections of S 288 x Kent, also from India, features as S 288.
S 288	good to high yields but high percentage of elephantbeans (poly-embryo) and lower cupquality compared to local arabica's. On lower altitude more damage by Berryborer and Stemborer.
S 795 and 1934	expectations good to high yields and somewhat better bean- and cupquality than S 288.

In general the 3 S-lines are fast growers and early producers with higher yields than the local arabica's, but with high % of elephant beans which results in "elephant ears", "bits" and "hollows" after processing and milling. This loss and its lower cupquality (acc. to the Japanese standards) make these lines absolutely unsuitable for further release among the

coffeegrowers, especially on marginal land for local arabic (below ± 1200 meters)around Lampahan and southern part of Silih Nara, but also on new land on any altitude above 1200 meter. Examples are the areas Jagung (transmigration project, 1500-1600 m.) and the northern area of Bandar. No quantitative data however are available about number of trees already planted and where.

The same applies for the Timtim variety.

"Timtim" or "Arabusta" — origin: from Timor Timur, most probably a selection of a natural interspecific hybrid (C.arabica x C.canephora) tall type; bronze tip; some selections show complete CLR-resistance; no data about yield yet but it is said to yield good in Aceh Tengah; higher % of elephantbeans, pea-berries and triage are expected, cupquality less than local arabica's.

The common and wellknown name is Hybrido de Timor (HdT) and it is the most important progenitor used in CLR-resistance breeding in the coffee-world. Some selections have also a good resistance to Coffee Berry Disease (CBD).
Through the Dinas Perkebunan this variety was also released in 1980 in Aceh Tengah and became also quite popular among growers.

AB 3, AB 4 and AB 7 — origin: Ethiopian, a pure arabica
tall type; broze tip; beansize good; cupquality very good.

These Abyssinian lines were introduced in 1928 by prof. P.J.S. Cramer in East Java and some of it found its way to Aceh Tengah, where it was given the name of "Rambung". The variety is not very popular among growers in spite of moderate susceptibility to CLR. It is said that production declines after 10 years and the size of the tree is too big, which decreases the number of trees/ha.

Caturra Red and - Yellow — origin: Brazil, an arabica mutant from Bourbon; dwarf type; green tip; very susceptible to CLR; high to very high yields expected; no data yet about bean- and cupquality.

This very attractive looking and compact variety with dark green leaves is very susceptible to all known races of CLR and therefore not to be recommended as commercial variety. Moreover high yields are expected and the degree of Overbearing and Die-back will be high as well. The one with yellow beans is confusing when the PDGM factory is trying to convince the farmers to deliver red cherries only.

Belawan Pasumah — origin: a C.arabica from Sumatra, Pasumah tall type; bronze tip; moderately CLR-susceptible; yield expected as local arabica; no data available yet about bean- and cupquality.

The original name was Pasumah and after planting in 1912 on Java it was further selected and given the name of Belawan Pasumah. It became a favourite variety among growers in Java at that time. It is said (Cramer Review 1957) to be CLR-resistant but at that time little was known about the great variability in pathogenicity, so more probably this cultivar is uncomplete resistant and only moderately CLR susceptible.
There might be a possibility that this cultivar found its way as well to the Aceh Tengah area.

All other varieties with names such as Bergendal, Sidi Kalang, Tator and Typica LTA are considered arabica typica types (Coffee arabica L.var.arabica; syn.var.typica Cramer).
Hardly any distinct differences are thusfar observed. They bear common characteristics of being all highly susceptible to CLR. All are tall types and have bronze tips and are probably original from Java.
The possibility exists that these varieties became more and more susceptible because of new Races of HV and increase of CLR outbreaks.

Problems identified

The major local variety Bergendal has adapted itself to climate and soils and is grown under shade during the past 50 years in Aceh Tengah. Low yields are obtained under traditional levels of inputs on altitudes above 1200 meter a.s.l. Quality has proved to be good to excellent. Below the 1200 meter most local arabica's have been replaced or, in case of expansion of coffee areas , planted with the interspeci-

fic hybrids "Jember" (S 288) and "Timtim" (HdT) because of better and earlier production compared to the local arabica's (Bergendal and Rambung), both having a certain degree of CLR-resistance and therefore not suffering premature leafdrop, Overbearing and Die-back.
However these two hybrids are not used (anymore) as commercial varieties in other coffee arabica growing countries, but for breeding programmes only. The inferior bean and low cupquality are the major limiting factors for commercial use.
It is still not understood why these 2 hybrids have been released in Aceh Tengah.
In the coffee areas above 1200 meter (approx. 70% of the total coffee area) the same trend has been observed, although less for as far as replacement of old plantations is concerned. The hybrids are mainly used for infilling of dead or damaged trees only. But for expansion of coffee areas mainly the hybrids are preferred.

Of course farmers' interest goes for quantity as quality is not paid for so far.

It is still a question how long it will take until all local arabica is replaced in the future with hybrids such as Jember and Timtim and others.

The Government policy is to increase production and quality, but the aim should be changed into increase of production through intensification and natural preservation of quality.

Quality can be improved by proper processing and millingtechnics, but fundamentally it all depends on the right variety grown by the smallholders.
To tackle this problem there are two options:

1. to preserve the local Bergendal through increase of production
2. to find a better CLR-resistant variety or hybrid with bean- and liquorquality as good as the local arabica.

Option 1

To improve the local arabica in terms of production, we are facing the major problem of CLR.
Any improvement through rehabilitation, replanting, fertilizer application, regular weeding and pruning and the control of pest and other

diseases are considered less effective if not combined with the chemical control of CLR.

Chemical spraying to control CLR is possible and practised after preliminenary research in many other coffee growing countries. However it is considered not applicable yet in Aceh Tengah because of the following reasons:

- Absence of an active and well staffed extension service to demonstrate treatments, to explain the hazards and precautions and to control application.
- Unfavourable climatological conditions; preventive spraying with copper based fungicides every 4 weeks during rainy season means in Aceh Tengah spraying nearly all year around!
- Most coffeeplants show the umbrella-shaped canopy, with a very dense foliage layer which makes spraying penetration and distribution impossible and thus less effective.
- Practical problems in the field are the moderate and steep slopes and in most cases the lack of water for spraying (approx. 400 1/ha/appl.)
- The high costs involved for equipment, chemicals and maintenance, but especially for labour.
- Lack of discipline and care of farmers because coffeegrowing in Aceh Tengah is still very extensive with minimum inputs.

Furthermore one should always bear in mind that chemical control should be carried out according to a very strict spraying schedule with the right dosis. If not, rustinfection will be even higher than without spraying at all.

Another alternative could be granular soil application with systemic fungicides combined or not with systemic insecticides.
The advantages are convincing enough; safer for humans, less negative effects for the near environment, easy and cheap application (once or twice a year should be sufficient) without expensive equipment and no water is needed.
Bayer in Jakarta has been contacted several times but the product is still not registered in Indonesia and samples even for research are not available yet.

Option 2

As far as improved plantmaterial is concerned one should realise and understand the complexity of CLR breeding, because of the great variability in pathogenicity of Hemileia Vastatrix.

After disastrous effects in South East Asia from 1867 onwards, concern about the potential threat of CLR to arabica coffee in the rest of the world led to the establishment of a Coffee Rust Research Centre (C.I.F.C.) at Oeiras, Portugal, in 1955. From there research on coffee rust could be carried out under international cooperation without the danger of introducing new races of the pathogen into coffee producing countries.

32 Physiological races have been identified sofar* and a hybridization programme was started in close cooperation with research stations in many coffee arabica growing countries.

Putting it in a nutshell the hybridization programme consists mainly of crosses between Hybrido de Timor genotypes,** with their extraordinary characteristics of complete resistance to all known races, and another parent, the Arabica cultivar Caturra, a mutant of the Bourbon type, known for its good productivity potential and its compact size, but highly susceptible to CLR. The derived cultivar is called CATIMOR.

Well-screened and selected Catimor progenies of next generations were used again as progenitors in various back-crosses with wellknown high-yielding, good quality arabica varieties from several coffeegrowing countries like Catuai, Caturra and Mundo Nuvo from Brazil, San Bernando from Colombia and SL-lines and Bourbon from East Africa.

In 1987 the LTA Agronomy Section started international correspondence with various research Institutes and Projects after a short consultancy mission from Dr. Ir. Soenaryo, the Director of the Research Institute for Estate Crops, Jember, East Java and Mr. op de Laak, Coffee Advisor to the Highland Coffee Research and Development Centre Chiang Mai, Thailand (1-8 May, 1987).
With the kind assistance of Institutes and Stations from Portugal, Thailand, Australia, Brazil, Papua New Guinea, India and (Kenya) the Project was able to start a programme with some advanced plantmaterial,

* In Indonesia up to 11 races of HV are identified by the CIFC, Portugal, sofar.

** CIFC - 832/1 and CIFC - 1343/269.

in order to be able to compare local arabica's, existing hybrids, pure Catimors and back-crossed Catimors.
For future planning even back-crosses of advanced generations of complete resistant Catimors with the local Bergendal will be possible.

For the future intensification programme in Aceh Tengah the derived compact cultivars offer the following advantages besides the complete CLR-resistance:

- Harvesting operations and phytosanitary treatments are easier to carry out and are therefore more economic.
- High plant density can be used with dwarf type, resulting in higher yields per unit area. (The dwarf type produces as much or even more than tall types)
- It is also expected that nitrogen fertilizer response will be higher.

The fact that these new cultivars are going to be very popular among farmers is already demonstrated in South Silih Nara. (see next chapter)

The local dwarf type variety "Jaluk" or "Kopi Ateng" *

During a field visit in the southern area of the Kecamatan Silih Nara in March 1988, the attention was drawn by a coffee farmer who wanted to show a particular dwarf type tree in the middle of his Timtim coffee-plantation. It appeared indeed to be a compact Caturra-like tree but surprisingly with no signs of CLR.

About 8 years ago, the owner received a batch of "Timtim" seed through the Dinas Perkebunan. The seed coming from Timor Timur, so it was presumed the cultivar had to be Hybrido de Timor or a selection of it. Because of its extraordinary characteristics seed of the single dwarf type was collected by the farmer and about 100 seedlings raised and lateron planted in another field. Production of these, now approx. 5-year old, F-2 trees was that promising that the attention of neighbouring farmers was drawn to it and the owner started selling seed for extremely high prices.

* Ateng - dwarf

According to the Head of the UPP-PK Angkup, farmers in this area (around 1000 meter a.s.l.) started about 10 years ago to infill and replace local arabica's with S 288 and HdT varieties. The past 2 years however, more and more farmers prefer the "Ateng" coffee. He estimated that more than 40% of the arabica is now replaced by the 3 hybrids. The main reason was that arabica's showed heavy premature defoliation and Die-back, which is undoubtedly caused by CLR on this altitude. Rust outbreaks cause serious damage and even the Robusta coffee shows heavy rustinfection.

Samples of the "Jaluk" coffee were collected by the Agronomy Section of LTA, cherries properly processed for cupquality were sent to Switzerland (see Annex) and parchment as seedmaterial sent to the C.I.F.C.** at Oeiras, Portugal for determination of physiologic group of CLR-resistance and part of the parchment for own experimentations.

Samples or uredo spores of a few Jaluk trees showing susceptibility to rust were collected and later sent to Portugal as well. Unfortunately when received, the rust was already white and is therefore probably useless for determination of the physiologic group of CLR-resistance. New samples have to be collected and sent again.

Information was requested from the C.I.F.C., Portugal about possibilities of origin of the Jaluk coffee.

The first liquoring test and analyses of Jaluk coffee from Switzerland are positive.

Information from the C.I.F.C., Portugal is the following:

Most probably the "Jaluk" coffee is a derivative of the CIFC HW 26; Caturra Vermelho x HdT, introduced in East Timor in the late 1960's, when a programme of coffee improvement was going on in that former Portuguese territory.
As the Jaluk coffee mother tree already presents green tips, it means that it is already a second generation or a more advanced generation of Catimor. The low % of bronze tips from the derivative F2 from the mother Jaluk tree (for the time being referred to as F-1) is explained because the tree was not selfed and some of these plants resulted from

** C.I.F.C. = Centro de Investigacao dos Ferrugens do Cafeeiro - Coffee Rust Research Centre

crosses with alien pollen from the bronze tipped HdT (Timtim) trees around.

It was proposed to self the mother tree and analyse its progeny, plant by plant, regarding the following parameters: size, yield, vigour, % empty fruits, % pea -berries, beansize (grading), liquor quality and disease incidence.

In the meantime the news of the "Ateng" or "Jaluk" coffee is spreading like fire and farmers are very keen to obtain this variety.
It is regrettable that this is happening while the LTA Project just started its programme to collect other more promising CLR-resistant dwarf types to screen and select in order to provide mother plants and their progenies to be studied further in fieldplots of different coffee-zones, or for use of seedproduction and distribution.

The spread of the Jaluk coffee goes without any control and naturally cannot be stopped.
No selection and screening takes place and in farmers fields a certain number of plants are attacked by CLR, adding more problems to the already serious situation of CLR in Aceh Tengah as it may lead to a rapid development of new races.
In case the Jaluk coffee becomes less wanted or farmers become disappointed again by some reason, the future CLR-resistant dwarf coffee to be released by the future Research Station will be received with scepticism and distrust.
To tackle this problem the folowing is recommended:

It must first be made very clear that the LTA/Agro-research section is not recommending this Jaluk coffee as a future cultivar to replace the existing coffee varieties.
No basic data are available about the exact origin and generation, about physiological group of rust races, productivity and production lifetime, about incidence of other diseases than CLR and pests, about bean- and liquor quality.

The LTA/Agro-research section should put all efforts in obtaining the data about origin and generation. A visit to East Timor seems to be necessary as correspondence failed. Reports about the trials in East Timor must be available, either from Timor or from the CIFC, Oeiras,

Portugal.

Surveys should continue in the field, starting from the centre desa Jaluk where several F2 gardens produce seedmaterial for expansion. From all parameters the degree of CLR infection is the most important.

The Dinas Perkebunan could take the following actions:

Existing Jaluk gardens: Convince farmers to replace all attacked coffee plants by rust as wel as the tall types and the ones with bronze-tips. Find a way how to compensate farmers if necessary.

Existing farmer nurseries: With the assistance of the Project start selection and heavy screening. Here too a compensation arrangement might create goodwill among the farmers.

Seedgardens: Mother trees should be selected and protected against theft. Seed from these trees should only be used for seedling production.

Future nurseries should be set up by the Dinas Perkebunan only. Technical backstopping should be supplied by the LTA/Agro-research section.

The above mentioned recommendations should be discussed thoroughly with the Authorities and Agricultural Services at TK.I-level. It is up to them to involve the Jember Research Station and/or Headquarters of Dinas Perkebunan.

EXPECTED YEAR OF FIRST ISSUE OF CATIMOR LINES

The most advanced generation (F7) of the Catimor lines are those from Queensland. This material does not require further selection for uniformity in resistance to CLR, compact growth and vigour.
Yields are expected to be much higher than the local arabicas and even the other hybrids in this area.
Beansize and liquor quality are also expected to be good (results of research elsewhere and indication of Jaluk coffee).

4 Lines are planted in Field VIII in October 1988 and 1 line will be planted in October 1989.

In 1991 the first amount of seed material can be expected provided the lines fulfil the needed requirements.

If from the total number of 10.000 trees 5.000 mothertrees are selected and each produces about half a kilo of seed (=1.000 seeds) and counted with a mortality/selectionrate of 25%, 3.750.000 seedlings can be distributed in 1992.
This is about enough for approx. 1.000 ha or 16.000 rantai if closely planted, which means that about each household could plant/replant 1 rantai.

This would mean that 100 nurseries should be set up of each 50.000 seedlingcapacity, like the existing nursery on the Project compound.

Of course above figures are indicative but they give an idea about the impact of work and preparations to be made. For example 10.000 tons of topsoil is to be collected and prepared to fill the 5.000.000 polybags. It is therefore of utmost importance that enough personnel is going to be trained in Nursery Management during the season 1989-1990.

From the other selections of the 4th and 5th generation eventual seedsupply cannot be expected before 1995.
The material from Kenya is of special interest as its origin is of Hibrido de Timor 1343 with the additional resistance against Coffee Berry Disease. Although CBD is no problem in Aceh Tengah it is safe to have that line in stock.

Coffee nurseries

Commercially grown cultivars are propagated by seed as fas as C.arabica is concerned because they are predominantly self-pollinated and homogygous. Coffea canephor (robusta), C.excelsa and C.liberica are largely selfsterile and seed of these species are therefore cross-pollinated and the progeny very variable.

To increase production and improve quality of coffe arabica the first steps to be taken are :

1. choice of cultivar
2. seed supply
3. nursery management.

1. Choice of cultivar

This is the task of research and policy makers.

2. Seed supply

Ideally seed should be certified by an official body which takes care of seed production, treatment, selection, storage, distribution and control.

In the past the coffee growers in Aceh Tengah used spontaneous seedlings which germinated under the coffe trees from scattered cherries. These seedlings were uprooted, trimmed and then transplanted in the fields. The sudden shocks retarded growth of these unselected and wild growing seedlings and sometimes provoked poor performance during the whole production period or lifetime of the trees.

The Dinas Perkebunan introduced nursery technics with seed supplied from somewhere in East Java, using cultivars such as "Jember" and "Timtim"

The Agronomy Section of LTA started to look for mothertrees of the local Bergendal-type after discovering the problems around the newly introduced above mentioned hybdrids. From the local arabicas, Bergendal is the most favorite among growers, with good bean- and liquor quali-

ties and therefore chosen by LTA as the commercial variety for the time being.

Efforts were made to select mothertrees at farmers' fields. The owners assisted during selection indicating trees which had proved to be capable of producing good average yields. Uncertainties about performance of course remain as basic information is coming from the growers only.

In the meantime improved plantmaterial has been planted in the Fields VIII and IX (total 8 ha) in such amounts that eventual seed production of the future lines is secured.

3. Nursery management

The nursery technics introduced by the Dinas Perkebunan through the UPP-PK programme are more or less followed by the private sector. Some using the bare-root system, other the container grown seedling system. In most cases both systems leave much to be desired and it is regrettable that the Dinas Perkebunan ceased seedling production after the first initiatives.

The LTA Project's nursery was set-up in 1984. The system chosen at that time was for overhead shade of container grown seedlings raised in seedbeds. Detailed information can be found in the Technical Advisory Manual Recommendations on Improved Coffee arabica Nursery Management in Aceh Tengah.

The system can be summarized as follows :

- Pulping of selected cherries by hand, 1st fermentation, washing, 2nd fermentation, drying under shade and final selection.
- Sowing on raised seedbeds containing treated soilmix, covering seeds with 1 cm of soil and a thin layer of mulch. Seedbeds are placed East-West direction and are provided with overhead shade and roofing to control water supply. As soon as seedlings start to emerge the mulch and roofing are removed.

- Filling the polybags with potting-mix of topsoil, compost, fertilizer and chemicals to prevent nematodes and fungus development; the bags to be placed under the overhead shade of the nursery.
- Transplanting seedlings at match-point or butterfly stage by pricking out and planting into the polybags. Again selection takes place.
- Maintenance; watering, weeding, fertilizer application, preventive and curative pest & disease control, sun-hardening and rogueing.

This "ballplanting" or container-grown seedling system is preferred to the bare-root system where seeds are sown direct in permanent beds and uprooted when transplanted.

The main advantages of raising coffee seedlings with the "ballplanting" system are :

- quick establishment of the seedlings after transplanting without any set-back as rootsystem is not disturbed or exposed;
- no rotation of the nursery site is needed since fresh potting-mix has to be prepared at the start of each nursery campaign and thus frequent re-use of the same soil, which may aggrevate diseases, is avoided;
- after purchase the coffee growers can defer transplanting until weather conditions are favourable;
- less land is needed (approx. ¼ if compared to the bare-root system);
- efficient maintenance activities such as watering, weeding, fertilizer use, control of pests & diseases and selection.

A main disadvantage is transport of the 2 kg heavy bulky polybags. It is said that the bare-root system is cheaper but if one considers the larger area needed and the high prices of land in Aceh Tengah, with the problems of rotation and the heavy losses of seedlings after transplanting, the price might be even higher.

Cost calculation for the commercial seedlings and routine maintenance have been somewhat hampered as seedlings of improved plant material were raised all year around in the same nursery.

This problem has been solved by adding another low-cost and simple nursery in 1988. Besides that, the construction serves as sample for the future nurseries, this section facilitates the screening and selection procedures of this improved plantmaterial considerably.

The experiences gained from the past 3 seasons and various experiments are being assimilated in the Technical Advisory Manual.

Basic improvements are :

- Period and timing of sowing.
- Efficient use of available topsoil on site for the future nurseries.
- Simple and strong construction systems for both pre-nursery seedbeds and nursery overhead shade.
- Use of shade segments which can be removed for sun-hardening of seedlings and for off-season storage and maintenance.
- Soil treatment to prevent outbreaks and spread of nematodes and soil borne diseases.
- Efficient sowing and transplanting systems.
- Preparation of soil-mix using compost from coffeepulp and removal of "oxalis"-bulbs, the most persistant weed in Aceh Tengah.
- Efficient use and application of Nitrogen-fertilizer combined with watering.
- Preventive pest & disease control combined with foliar fertilizer applications.

A hand-out for farmers about land preparation, transplanting and after-care was prepared and will be translated into Bahasa Indonesia.

With the prospect of eventual new commercial varieties in the near future (see Expected year of first issue of CLR-resistant dwarf types) the following is recommended:

- Start as soon as possible with planning concerning :
  * number of nurseries, their capacities and location.
  * funds and manpower needed.
  * organisation and distribution.
  * involvement and responsibilities of parties involved.
- The central or nucleus nursery should be situated in the Kecamatan Bandar with 40% of coffee of the total area in Aceh Tengah.
  From this centre, supervision and coordination should be carried out.
  Pre-nursery activities for all satelite- nurseries could be implemented from this nucleus nursery to facilitate supervision, management and control.
- A large number of "Heads" for the satelite nurseries should be trained on the job on the LTA-nursery in Pondok Gajah during the season 1990/1991.
- As soon as the nurseries are created and functioning with a continuous supply of seed from the Research department it should be made clear to all parties involved in coffee production that introduction of coffee seed from own supply or from elsewhere by individuals, has to be strictly forbidden.
  The only institute to introduce or to test new coffee lines is the future Coffee Arabica Research Station , Aceh Tengah.

Shade, windbreaks and covercrops

General situation

In Aceh Tengah Lamtoro (Leucaena leucocephala) is predominantly used to provide permanent shade for coffee.
Other species, mostly fruittrees are used as well as mix cropping. In some cases the Lamtoro is replaced with citrustrees.
In young coffee gardens, where Lamtoro is still too small to provide sufficient shade, banana trees are planted although this is more a question of intercropping rather than shading.

Other trees used for mix cropping are : jackfruit, avocado, guave, water-apple (plumrose) and some cinnamon.

All these non-leguminous trees are expected to compete seriously with the coffee for available nutrients and the shade provided is often too dense or too irregular.

From the above mentioned trees only the citrus has a real economic value.

The choice for the future : shaded or unshaded coffee?

In general coffee grows well without shade, under some conditions. It demands great care and high inputs by the farmers, both not common in Aceh Tengah where coffee is grown extensively with a minimum of inputs.

The benefits of coffee shade are given in the following summary :

- extends the productive life of the coffee tree
- gives a good protection against the strong winds in Aceh Tengah
- gives an extra supply of nutrients
- reduces the risk of over-bearing and die-back
- gives a more even annual cropping
- provides a favourable micro-climate
- rootsystem of the shadetrees may assist in soilprotection on slopes (landslides)

For these reasons the practice of light shade should be retained for the time being until the attitudes of the coffee farmers towards modern coffee cultivation are gradually changed.

The ideal shade tree

In Aceh Tengah the choice of Lamtoro has probably been on basis of experience and observation or just copied from East-Java, where quite some research has been done before it became the recommended tree.

The Lamtoro tree served its purpose in Aceh Tengah until the outbreak of Jumping lice (Heteropsylla sp.) in 1986. This pest defoliates the tree completely, several times a year for long periods.
One of the qualities of Lamtoro is the great rejuvenative power and healthy trees survived the attacks sofar. Trees which are dying or dead by now, were most probably already suffering from a root disease.

The Agronomy Section, alarmed by the continuous spreading pest, prepared a programme to combat the Jumping lice (see chapter Pest & diseases and save the coffee tree from overbearing, die-back and permanent exhaustion.

Replacement of dead Lamtoro trees was part of the programme. The choice of species to replace the Lamtoro with had to be made.
Recommendations from elsewhere are worthless as conditions in Aceh Tengah differ too much. However time for research is limited as the problem requires a quick answer.

The Agronomy Section fortunately already started to collect various species of permanent shade trees, windbreaks, temporary shade trees and leguminous covercrops in 1985, with the main objective to create a collection for training purposes only.
Difficulties were experienced to obtain proper seed and because land was not available, the collection remained small.
The available species were evaluated according to a list of qualities , based on experiences, observations and assumptions.

Qualities	Leucaena leucocephala/Lamtoro	L. giant/Lamtoro Gung	Gliricidia (sepium)	Albizia (?)	Kaliandra	Acacia (villosa)	Erythrina (?)/Dadap	Casuarina (oligodon)	Sesbania (grandiflora)/Turi [1]
Long life > 25 years	+	+	+·	+	+·	o·	+	+·	-·[1]
No brittle wood	+	o	+	-·	+	+	o	+·	
Spreading habit after training	+	+	o	+	o[2]	-[3]	+	-	
Providing even shade	+	o[4]	o	+	o[4]	-	o	+·	
No hostplants (soilborne diseases)	o	o	+·	+·	+·	+·	o·	+·	
No leaf attack by pests	-	-	o[5]	o·	+·	o[6]	-·	+·	
Low nutrient competition	+	+	+·	o[7]	o·	-·	o·	-[7]	
Fairly rapid grower	-	+	+	+	+	+	+	+·	
Good quality firewood producer	+	o	o	-	+	+	-	o·	
Easyness of propagation	o	o	+	o	o	o	o	o·	

Classification

+ good condition

o fair/sufficient condition

- insufficient condition

· assumption

1. Very poor performance: poor germination, high mortality.
2. No experience yet with training; if untrained bushy appearance.
3. After topping side branches grow upwards and crown becomes dense.
4. No even shade because of big clusters of pods.
5. Some problems with black aphids, which may attack young coffee leaves.
6. Once a year defoliated by catterpillars but recovers quickly.
7. Because of big shape root competition is expected for closeby coffee trees.

Some concluding remarks

1. Lamtoro and Lamtoro Gung are scoring high but the limiting factor is the high susceptibility to Jumping lice. If the pestcontrol is not tackled on a regional level according to the proposed integrated system of the Agronomy Section and no biological balance occurs in the near future between the Jumping lice and its predators (this balance is not expected because of the difference in multiplication rate of pest and predator), the tree is bound to disappear.
   Resistant or tolerant varieties are being acquired for but may take some time to obtain, propagate and test in the field.

2. Gliricidia is considered as one of the best alternatives. The limiting factors are still the incidence of leaf sucking black aphids, some seasonal leaffall. Furthermore it provides a less quality firewood compared with Lamtoro, which is important for farmers.
   But because of easiness of propagation by means of cuttings and fairly rapid growth, it was recommended as replacement for dead Lamtoro since 1988.

3. Albizia might be a suitable species, but the limiting factors are wind damage and unwillingness of farmers to plant them because of labour intensity to thin and prune the tree.

4. Kaliandra, considered sofar as second best, but the tree is recently introduced so qualities are still uncertain.

5. Acacia is unsuitable because of the limiting factors of uneven shade, high pruning costs and competition for nutrients. However it is very suitable as windbreak if topped regularly.

6. Erythrina, thornless type, unsuitable because of heavy attack of leaffeeding weevils and bad quality firewood.

7. Casuarina might be a solution, but its habits are not known under the local conditions. The tree is used in PNG by smallholders. Seed sent last year never reached its destination. The available seedlings at the moment come from Brastagi and are used as windbreak in Field IX.

Windbreaks

Besides the above mentioned species another trial in Field I is in progress. Here a double row of temporary windbreak Crotalaria with a permanent row of Cinnamon was planted 3 years ago. The Crotalaria row, which provides only protection, was removed after the Cinnamon row reached a height of approx. 3 meters.
The Cinnamon was planted every one meter and reaches now a height of 3 @ 4 meter. It is planned to cap every alternating tree after 4 @ 5 years to thin the windbreak and to obtain some extra income from the bark. The capped trees are allowed to shoot and one "head" will be selected for a second cycle.

Other species of economic value to use as windbreak might be citrus, avocado and jackfruit.

If in the near future more dwarftype coffee will be used for replanting, combined with improved practices, shade trees are not needed anymore, but windbreaks become a must.

With the longterm objective of cropdiversification, a stripcropping system - planting in alternate rows:coffee, fruittrees or other species of economic value and annual cash- and foodcrops - will be an interesting possibility.

Temporary shade

The following species have been tested : Tephrosia, Crotalaria, Pigeonpea and Cacia of which Tephrosia was far the best.
Its qualities are :quick germinator, quick growth, easy pruning, high quantities of green manure, good spreading habit, little pest and diseases, good indicator of marginal soils and high production of good quality seed.
It has some problems of nematodes but spread can be avoided through pocketplanting in the middle of 4 coffee trees.
The Agronomy Section is selling seed and the specie is now commonly knows among farmers, but unfortunately it is still used on a small scale as farmers prefer to intercrop between the rows of young coffee.

Pigeon-pea could have some economic value but there is no market for the product yet because of unacquaintancy. Besides it suffers from pod boorers and shade provision is declining after the 2nd year.

Soil covers

In 1986 a total of 13 species have been tested on a small scale. From all species only one, the Desmodium intortum cv. Greenleaf, gave entire satisfaction in terms of capability to suppress other weeds.

It produces high amounts of organic matter and it tolerates regular slashing. For the future soilconservation methods, it will be of high value.

One disadvantage is the high price of seed. Efforts to start own seed-supply on a large scale have been disrupted as the field had to be used by the project factory for the expansion of drying tables.
Another small field was used instead and it was observed that seed processing was extremely difficult because of the stickyness of the pods and the very small size of the seeds.
To decrease labourcosts the use of semi-processed seed will be more practical in the future.

Trials on Field VIII and IX

On Field VIII and IX where the collection of CLR dwarftypes have been planted, trials are being set-up to test this variety unshaded and shaded with al kinds of temporary and permanent species. Different species for windbreaks are planted as well.

It is expected however that the dwarftypes, if released, should be planted with temporary shade only during the first 2 years. The dual purpose of this temporary shade is to suppress early flowering and to supply green manure, but more important to protect the young coffee plants against the strong dry winds. The system should also be combined with early establishment of windbreaks.

Wind breaks on shelter belts.

The Lamtoro as shade tree provides protection against strong winds. The degree of protection however is not known yet. Coffee fields next to an open area at the windward side will suffer more from wind damage, specially the first rows of coffee trees.

A close planted row of trees will decrease damage. If coffee without shade is considered (e.g. trials in field VIII + IX) the following directions should be kept in mind.

- The effect of the wind break depends on its height and on the distance behind this barrier.
- For belts with a height h of approx. 10m, a velocity reduction of more than 20% can be obtained up to heights of 95 h. and up to a distance of 15 h.
- Higher belts have relatively less effect.
- A porous belt or screen has much more effect than a dense one. The best effect is obtained with a belt of medium density and a dynamic porosity of about 40 - 50%.
- A second belt gives less protection than the first most windward one.
- Openings in the belt give rise to higher wind speeds (wind turned effect!).

Fertilizer application

In Aceh Tengah fertilizer application was not a common practice until the Dinas Perkebunan and the PRPTE-project started in resp. 1976 and 1979/80 with the introduction of a rehabilitation package, including fertilizer application. Recommendations given were based on all kind of suggestions from the BPP in Jember, Pusri and Dinas Perkebunan and were applied in the field.
The criteria of the recommended quantities of fertilizer are not known, but are probably far too high for shaded coffee if production increase is the objective. The basic rules and understanding of fertilizer application for coffee arabica might have been overlooked.

In general it can be stated that fertilizer application to shaded coffee has little response. Much higher responses are obtained from fertilizer application to unshaded coffee.
The relation between increase of light intensity and flower initiation and the successive increase of crop which then needs supplementary nutrients might not be clearly understood.

In 1981 a soil fertility appraisal for preliminary fertilizer recommendation in the smallholders coffee area in Aceh Tengah was made by Mr. R.A. Leyder. The quantities recommended are much lower and it was calculated (Schuiling 1982) by means of an economical analyses that these quantities are likely to be highly cost efficient. However it was stated that application should be practiced in conjunction with various improved cultivation measures.
So it is still not known whether it will be the fertilizer application or for example the pruning or both which will determine the increase in production. As stated before, everything is based without basic and quantitative data from trials applied in the coffee area of Aceh Tengah.
LTA Agronomy Section however has used the recommendations by Leyder as a guideline for the time being.

It is also believed that all recommendations were calculated or estimated with an under-estimation of the CLR-problem in Aceh Tengah.

The author's opinion is that fertilizer applications, whatever dose this

may be, are a necessity for sustainability of production rather than to increase production as far as the rust susceptible local arabica is concerned. A substantial increase in production can only be expected if CLR-control is included in the package of improved technology.
Therefore the ambitious plans during the initial period of the Project to start all kind of fertilizer trials have been postponed until the CLR-problem is solved.

Only one fertilizer trial has been established on the project compound with a rust resistant variety, USDA 230762, on Field II. Later on the information appeared to be incomplete as the variety was only partial resistant and rust symptoms were discovered in the field.
The variety though looks promising enough and valuable data can be expected. Being a long term experiment, no conclusion can be drawn sofar for as far as production is concerned
The treatments are according to the design of Leyder. Soil samples were taken and analysed by the Research Institute of Jember.
Regular sampling of leaves for foliar analysis are planned before and after first harvest data will be collected.

On Field VIII and IX, where the rust-resistant dwarf types are planted, various fertilizer trials are being initiated.

Rehabilitation and growing

The cause of umbrella-shaped trees

In the coffee area of Aceh Tengah the single-stem pruning system is practiced from early days for arabica as wel as robusta coffee.
The young trees are allowed to grow until they are topped (capped) at a desired height (between 1.40-1.70 meter). This moment of capping is reached after approx. 3 years and during this period no maintenance pruning is carried out.

After capping, the height is maintained by desuckering (removal of vertical- or orthotropic shoots) but no further pruning is practiced. The top two pairs of primary branches produce much more vigorous growth than the lower pairs. When the top pair is not thinned regularly a very dense canopy will be formed. The lower branches, already weakened as growth is unevenly distributed, become over-shaded and finally die back. Once a lateral or primary branch dies back or is cut up to the main stem there is no other accessory bud at the nod to produce new primaries!

The process is also accelerated by the incidence of leaf-rust which develops extremely well under the humid and dark conditions under the dense canopy and causes early leafdrop and die-back.

The final result is thus : a coffee tree with a long main stem, a couple of knotty top primaries carrying a tangle of spindly side branches, forming a "head" whose appearance, when defoliated, looks liks a kind of stork's nest. Long droopy and whip-like branches are hanging down until they touch the ground, forming a dense skirt around the main stem, restricting inflow of light and air.

The lower the altitude the more pronounced these umbrella-shaped trees become, as the rate of growth is faster and the attack by rust more severe.
Coffee trees without maintenance pruning and allowed to grow into this shape are less productive and more sensitive to certain pest & diseases compared to properly pruned trees. Needless to say that picking is difficult and eventual spraying impossible.

Objectives of pruning

Before introducing a system of pruning, developed elsewhere, one should consider several points of local conditions in Aceh Tengah and check whether they correspond with that system.
The knowledge of physiological characteristics of the arabica coffee tree is of utmost importance.
The objective of pruning is not to obtain a quick increase of production, which is a general idea of farmers and extensionworkers, but the objectives are more geared towards an economic way to obtain healthy trees with sustained production, avoiding biennial bearing, overbearing and die-back.

The general objectives are further listed as follows :

- to regulate and to even out the biennial bearing cropping cycle by reducing the ever returning overbearing and die-back
- to maintain a fairly open canopy of foliage, especially in the upper part of the tree to permit inflow of light and aircirculation which will reduce incidence of certain pests & diseases
- to regulate and encourage growth of new and future stems and branches, providing the next crop by removing dead or dying-, diseased or damaged-, old or unproductive stems and branches
- to maintain the trees in manageable and fairly open shape for easy picking and phytosanitary treatments and/or foliar fertilizer applications.

Problems of pruning

A major problem of pruning in Aceh Tengah is caused by climatological conditions. No distinct "flush" or major flowering, but numerous minor flowering occurs at any time of the year because of the virtual permanent rainfall distribution. This explains also the prolonged harvest period.
Normally pruning activities should start after harvest, during the dormant period. This period is lacking or the short dry season may not be dry enough to allow the coffee trees a period of complete dormancy.

After harvest the trees bear the signs of the next crop in the form of flowerbuds, flowers, pinheads or even green cherries.
Farmers are, for obvious reasons, reluctant to prune and very often postpone pruning until yields are expected to be low for the next season. However this is often the case after years of overbearing and trees often suffer from depletion of foodreserves. This is not the right moment for heavy pruning. The tree should be allowed a rest first.

A second major problem are the outbreaks of leafrust causing premature leafdrop and therefore disturbance of the leaf/fruit ratio. This is explained more in detail under the chapter "pest & diseases" (page .

The above mentioned problems are very complex and interrelationship should be carefully studied in the future by the Research Station, including other factors as spacing, growthhabit of the cultivar, rate of growth, presence or absence of shade and eventual requirements for pests and disease control.

A minor problem is the local availability of proper pruningtools. The agent of good quality tools in Jakarta was contacted and samples are being tried out at the moment.

The UPP-PK pruning system

The PRPTE-project* executed through the 10 UPP-PK's started in 1979/80 with 3 types of coffee development package programmes, based on :

- Expansion ("Perluasan")
- Replanting ("Peremajaan")
- Rehabilitation ("Rehabilitasi")

The first activity was stopped by the Indonesian Government after a couple of years, due to the decision made by the ICO to restrict coffee areas in the world. However in reality the expansion went on uncontrolled and haphazardly (approx. 16% of actual total area according to the Dinas Perkebunan). In the meantime expansion of arabica coffee was allowed again by the Government in 1989.

* PRPTE = Proyek Peremajaan, Rehabilitasi dan Perluasan Tanaman Ekspor
Project for Replanting, Rehabilitation and Expansion of export-crops

The second activity of replacement of old unproductive coffee trees by uprooting and replanting was not successful because of unwillingness of farmers (drop of income during 3 years).

It was through the rehabilitation package that pruning was slowly adopted by the coffee growers in Aceh Tengah.
The introduction of pruning systems was not an easy task for the still unexperienced extension agents and even unfair considering the fact that no backstopping whatsoever was given and the ambituous targets laid down by central management.

The UPP-PK pruning system consists of 2 stages :

- Heavy pruning where the "head" of the coffee tree is drastically thinned until the main top-laterals are barren with some spindly branches left.
  A heavy and time consuming task (± 20 minutes/tree or ± 20 trees/MD) and if done by a "contractor" the costs are between 400.000 and 500.000 Rupiah per ha., depending on number of trees/ha.
- Maintenance pruning or handling where the flush or young shoots are pruned by hand at least every 2 @ 3 months.

The latter often not carried out regularly by most farmers, the tree will take its old shape within a couple of years.
It is believed that this light- or maintenance pruning should be undertaken by women because of the interrelationship between an "open" well pruned tree and harvesting predominantly carried out by women.
Timing of picking, estimation of yields and easiness of picking are the advantages of a well pruned coffee tree.

The major disadvantage of the UPP-PK-system is the extremely high number of mandays (MD) of approx. 75/ha. for heavy pruning only. This is a common complaint of farmers and might be also one of the reasons that pruning is still not practiced on a large scale.
Local verification tests to measure costs and benifits are still absent as well as retrospection or evaluation afterwards.

New introduction and/or tests of rehabilitation- and pruningsystems

The Agronomy Section initiated a number of rehabilitation- and pruning-systems for CLR-susceptible and tall arabica types, with a clear differentiation between the :

1. old umbrella-shaped trees
2. young coffee plants

1. The old trees can be pruned according to the UPP-PK system but a better way is by rejuvenation and successive conversion into either a new single-stem or multiple-stem pruningsystem.
   Rejuvenation process applied by :
   - drastic stumping : cutting back the main stem approx. 45 cm. above soillevel, or by
   - side-pruning : cutting back east-side of the "head" and bark-nicking (east-side of the stem about 45 cm. above soillevel) to stimulate sucker growth.

   The latter allowing some crop to be taken during the first year and maintaining a certain equilibrium between roots and leaves.

   Formation, maintenance, pruning and recycling systems for both single-stem and multiple-stem are virtually the same for young coffeeplants and are explained under point 2.2.

   A long-term experiment was drawn and prepared to test the rejuvenation-system. The following treatments per replication or block of approx. 1 ha. was designed :

   - traditional system
   - UPP-PK system
   - sidepruning and transfer into single-stem system
   - " " " " multiple-stem system and infilling
   - stumping " " " single-stem system
   - " " " " multiple-stem system and infilling

All 6 systems to be tested under shade and without shade; with fertilizer applications and without (dose according to recommendations of Leyder 1981).
The objective was to find out through data collection and cost/benefit calculations the most practical and economic systems of rehabilitation and pruning for various types of coffeegrowers as far as their input-capacity is concerned.

For the experiment the 4 UPP-PK unused demonstrationfields (each approx. 1 ha.) in Bandar were requested but unfortunately no approval was given sofar.
Smaller trials to test the 6 systems under shade only with moderate fertilizer application were started instead with six farmers.
After the first year with great enthousiasme, the six farmers lost interest and part of the data could not be collected as certain activities were not carried out according to the plans.
Here again, the farmers postponed the cutting-back of the remaining stem with half of the crown of the side-pruning system after harvest and new shootdevelopment, because of the promising "next crop" signs.
As long as no significant proof is given or shown to the coffeegrowers that sacrificing some crop leads to greater benefits, they will remain sceptical about pruning.

As no other old coffee was available on the project compound because these were already cut by farmers before project activities started, the agronomist carried out some small experiments with 25 old coffee trees left in his back-yard.

2. Pruningsystems of young plants and rejuvenated trees (Fields I and IV)

2.1. Single-stem system of young coffee

The choice between capped and uncapped single-stem coffee had to be made. Because of a quick growth expected from the tall types the capped single-stem system according to the system Ferni, in Robinson (1964) was preferred.

The new coffee trees on the variety collection field I and Terras/Gliri-

cidia shade demonstration, field V on the project compound were capped at 3 levels, 50, 110 and 170 cm above soillevel. Successively one of the two verticals is cut after each capping, as well as the top lateral at the same side of the remaining vertical, to avoid "splitting" of the main stem.
During and after this "formation" period the primaries should be kept free of secondaries close to the main stem, in order to maintain an open tree to allow sunlight penetration and aircirculation.
The main pruning consists of removing all young suckers from the main stem followed by pruning of: inward growing- and downward growing branches, broken- or dead-, drooping and whiplike branches.
A second pruning or handling takes place in a later stage by further cutting back old wood and thinning out the new flush.

The system proved to be successful as far as strenthening of laterals are concerned. Data about yield for this system are not available yet as the 1st harvest season is not finished at this moment.
The system should be compared with the traditional system of single capping without maintenance, shaded and unshaded.
Data about labour inputs sofar are being worked out.
It is evident that the system requires much more labour and skill compared to the multiple-stem system.

The objective to test the system with and without Lamtoro shadetrees was unsuccessful as the just established Lamtoro trees were regularly attacked by the Jumping lice.

2.2. Multiple-stem system of young coffee - Field II and IV

The assumption was made that the multiple-stem system allows closer plant-distance because of the recycling process.

The system consists of capping the young coffeeplant of apporx. 70 cm. height back to knee-height approx. 40-50cm above soillevel (Ferni) or cutting between 4th and 5th lateral from soillevel (Ijen).
The two new verticals or "heads" are allowed to grow unpruned and to bear crop during 3 @ 4 years. After removing these two verticals 4 @ 5 new shoots are selected and these will form the new heads during the next

cycle of 4 @ 5 years. These again are then cut back except one which serves as the "lung" or "mama". While this single head is producing its last crop new shoots are selected for the third cycle, etc.
There are some variants possible, but the principle remains.
The length of a cycle depends on cultivar, climate and altitude.

The system showed more die-back of laterals, probably caused by CLR, over-bearing and winddamage. The Ferni-system, where laterals are allowed to bear one crop only and then pruned back, should be more carefully studied in the future.

Picking of last year cycle crop is difficult because of the height. The advantage however is that labourcosts are much lower than with the single-stem method.

For the time being the multiple-stem system under shade in not recommended but trials should continue in the future.

Conslusions and recommendations for conversion of rejuvenated old coffee trees into single- and multiple-stem

- Old and unproductive coffee trees can become productive after rejuvenation and the system offers possibilities of reformation of the tree.

- Bearing starts from the second year onwards. The first yield is lower than with the UPP-PK system, but increases afterwards and in the long run higher average yields are obtained.

- With moderate fertilizer applications especially during formation period risks of biennial bearing, overbearing and die-back are decreased.

- Labour inputs of stumping or side-pruning are lower and more evenly spread over the year than with the actual practice of the UPP-PK system.

- Absence of regrowth or poor performance of the coffee tree after rejuvenation gives an indication of poor producers and/or diseased trees. Those trees have to be replaced. Special caution should be taken for those showing root disease or nematode damage.

- Stumping in considered too drastic because of the "shock", a sudden disturbance of equilibrium between rootsystem and foliage.
  Preference is therefore given to the sidepruning-system to avoid this shock. Another advantage is that some crop is allowed to be taken during the first year.

- Conversion into a new single- and multiple-stem from stumping however gives better results. Internodes of new shoots are shorter and less damaged by wind compared to shoots from sidepruning.

- Regrowth of healthy trees is fast for both stumping and sidepruning. The period until recycling of multiple-stem system is short (max. 4 years)

- The speed of regrowth can be reduced by :
  a) 2 @ 3 x capping for the conversion into new single-stem
  b) capping the verticals at a height of 150-175 cm. for the multiple-stem system.

- In case conversion into multiple-stem is considered, infilling is recommended to increase number of trees per unit area.

- During rejuvenation and the first year of conversion shade by the Lamtoro (or other species) can be reduced to slacken the speed of regrowth of the shoots. Number of internodes remains but length decreases.

- Trees converted into multiple-stem show more pronounced set-backs, caused by rust outbreaks and therefore suffer from die-back.

- All rehabilitation- and pruningsystems have less effect if no CLR-control is included in the package of improved practices.

- The system of CLR-control by soil application of granules should be a major point for futre research.

- A consultant specialized in this particular discipline should be invited for a short consultancy.

Proposal of pruning systems with regard to CLR resistant dwarf types.

- Because of tradition the Single-stem system is recommended to the farmers for the time being until the dwarf types are introduced.
- Capping is only needed once on higher altitudes as strengthening of laterals is not needed and speed of growth untill the desired height takes much longer compared to local tall types.
- 2 & 3 capping on lower altitudes might be necessary.
- The principles of heavy- and maintenance pruning remain the same but small adjustments could be necessary.
- Tials to test the various pruning systems on fields VIII and IX should be carried out under shade and without shade. This is very important as effect of shade an the dwarf types differs considerably.

REPLANTING AND INTERCROPPING

Traditional replanting system :

It has been observed that farmers who decided to replace their old and unproductive coffee trees, planted the seedling too near the old coffee (up to 25 cm. from the trunk) or just between two old trees.
The young plant suffer from root-and light competition, from increased CLR infection and from wind damage by the long whippy branches of the old trees. Moreover, risks of infection by soilborn diseases and nematodes are optimum. Uprooting of the old coffee is very often postponed and delayed. When uprooting is finally carried out, part of the root-system of the young coffee is seriously damaged.
Remaining parts of old roots increase the risk of rootrot.
All above mentioned conditions provoke retarded growth and poor quality of bearing trees.
A number of trials at farmers field to test a system of gradual replanting by the "mata lima" system (planting one seedling in the middle of four square-planted old coffee), failed in one aspect as all farmers planted between two old trees instead. After three years the farmers did not uproot a single old tree. The reason is obvious, the young, poor-looking and spindy coffee produce very little. Special the CLR-susceptible varieties show in general a heavy setback becauce of the poor growing conditions.

Traditional intercropping system :

Intercropping between young coffee is practised by many farmers. The most common crops are : potato, tomato, chilly, cabbage and leek.
Garlic was planted in small amounts for home consumption only in the backyards. A common complaint of farmers was theft in far situated fields. Improvement of market andbetter cultural methods, as well as various seeds offered by the Government Extention Service for foodcrops (Dinas Pertanian) resulted in an increased production by farmers.
Higher benifits apparently made it worthwhile to start day and night guard during the ripening period.
The first 3 crops mentioned are hosts of various fungi and nematodes which endanger the growth of the young coffee.

During the intercrop periods the young coffee is taken well care off. As a result the coffee shows much less symptoms of setback if compared to new coffee fields where no intercropping is practiced.
However the benefits from intercropping are estimated to be low because of labour intensive weedcontrol and incidence of numerous pests and diseases.

Experimental Farms :

With the prospect of an eventual replanting programme with high yielding (HY) CLR-resistant dwarf type coffee, the Agronomy section and the Project Extension section planned to set up replanting experiments with the following objectives.

Short term objective :

- To test a system of gradual replanting combined with intercropping, which is acceptable to the average coffee farmer and his family, without a drastic decrease of income during the first 2 years of taking care of still unproductive young coffee.
- To test such a package of coffee growing technology based on improved traditional level of inputs.
- To calculate costs and benifits of each intercrop.

The package includes :

- Uprooting all coffee, lamtoro and other trees and proper clearing.
- Replant with (for the time being) selected local Bergendal cvs. 2,5 x 2,5 m.
- Intercropping with crops like garlic, onion, leek and beans in rotation. On no account crops like potato, tomato and chilly.
- Single-stem pruning with 2@3 times capping.
- Appropriate maintenance-pruning to avoid the umbrella-shape biennial bearing and to maintain a proper fruit/leaf ratio.
- Moderate fertilizer application to maintain soil fertility or application in case of overbearing.
- Regular weeding in case intercropping ceases.
- Preventive pest & disease control.

A control/check plot behind the Project compound of 4 rantai (2.500 m²) was added to the Project in order to be ahead of the planned activities and to keep records about labour and other inputs and to be able to test different plant materials and methods.

The programme was started in July 1988 on two farmers fields each 2 rantai (1.250 m²). Compensation and credit facilities were arranged by the Project to the owners of the fields. All activities went according to the working schedule and sofar the fields have been replanted and the first intercrop of garlic will be ready for harvest in Augustus 1989, to be followed by the second crop of beans.
For the time being chemical control against leaf rust is undertaken untill the soil application method can be tested.

Long term objectives :

- To create model farms with a strong radiation effect towards neighbouring farmers, showing a practical system of replanting and temporary intercropping with improved practices for higher and sustained production.
- To intensify coffee production with the aim of cropdiversification.

With the future HY. CLR-resistent dwarf coffee, production could be easily tripled if combined with improved cultural practices. To avoid risks of a mono-culture like coffee with worldmarket price fluctuations and overproduction, part of the available land should be used for other cash crops. Cost and benefit calculations for each crop and market surveys are part of this programme.
Of course the above mentioned system is only applicable on flat or slightly sloping land. Coffee on moderate to steep land which needs to be replaced should be replanted according to the contour lines to enable terracing at a later stage.
Decrease of income during the first years can not be avoided but will be compensated in a way by the dwarf type coffee which produces one year earlier than the local arabica's.

Conclusions and recommendation :

- A replantingsystem depends on slope steepness and incidence of rootrot.
- The traditional system of replanting should be discouraged.
  If the owner insists, then only if the above mentioned conditions are met and the Lamtoro trees are in good condition and regularly planted
  1st year : infilling according to "mata lima" system with CLR-resistant material.
  2cd year : uproot each alternate old tree and replant.
  3td year : uproot remaining old trees and replace.
  With this system approx. 140 trees/rantai or 2.240 trees/ha can be planted.
- If rootrot is observed either the whole field should be left fallow for 2 years after uprooting and clearing or spot treatment should be applied. Spot treatment consists of marking and isolating the attacked trees including the adjacent trees. Intercropping on this spot should be discouraged, because of the danger to spread the desease further.
- Grafting of resistant or tolerant species such as C.liberica and C.robusta with the commercial Variety could solve the problem but should be thouroughly investigated by the Research Section first, before introduction towards coffee.
- Replanting on moderate to steep slopes should be carried out gradually in strips following the contour lines. The introduction of a leguminous covercrop planted in strips between the coffee rows will improve soil conditions and decrease soil erosion.

WEED CONTROL

General situation

Because of climatologocal conditions in Aceh Tengah weedgrowth is luxuriant and continuous.
The traditional system of weedcontrol in coffeegardens consists of "clean weeding". Once a year deep-hoeing or deep-tillage is practised.

Several times a year, depending on the situation, a light hoeing is carried out. The frequency of this practice depends on several factors such as : plantdistance, pruned or unpruned coffee, type of weeds and other cultural activities elsewhere.
For instance close planted and unpruned umbrella-shaped trees require less frequent weeding. Perennial grasses demand more frequent and more intensive weedcontrol than annual broad-leaved weeds. In general priority is given to rice-and annual cashcrop cultivation activities.

Weedcontrol in newly planted coffee is often insufficient. The young coffee suffers from root, nutrient-and light competition.
Lower primaries are lost by die-back. Better performance of young coffee is observed when intercropping is practised.

The tendency has been observed that more farmers start using herbicides and mechanical slashing to control weeds.
The need of weedcontrol is generally recognized.

Methods of weedcontrol and some trials carried out

Prevention of weed infection

On Field IX waterbufalo's were allowed to graze during the fallow period after uprooting the old coffee and shadetrees and futher land clearing. Since spraying was not possible for a prolonged period because of unfavourable weatherconditions and weeds started to flower, mechanical slashing was carried out.

Mechanical and cultural control

1. Handpulling of weeds

   This system was introduced in the form of ringweeding by hand just before fertilizer application 3 times a year.

Naturally this is only possible with broad-leaved dicotyledonous weeds. If perennial weeds are present the system becomes ineffective as parts of the rootstock remain in the soil.
It was observed that labourers, not used to the system, prefered tools such as the handsickle (parang java).
By the repeated scraping of topsoil, coffee feederroots were damaged and bowl-shaped depressions around each main stem were created. Standing water during heavy rains in these depressions increases the risk of rootrot diseases.

2. H o e i n g .

This method is commonly used. Hoeing cuts off the weedplants from their rootsystem and is effective for controlling annual grasses and broad-leaved weeds. Hoeing is faster than hand-pulling but is also very labour intensive.

3. Tillage

Deep-hoeing was practised between the rows of young coffee only while keeping a safe distance from the rootingsystem of the coffeetrees. This method, with the aim to improve aeration and water infiltration, was carried out once a year, just before the rainy season.

4. Slashing

Weeds are cut down either by hand using a cutlass (parang babat) or mechanical by a motordriven hand-cyclemower.
Slashing weeds is practised when weather conditions are too wet for spraying herbicides or for hoeing, but also in case of prevention of weed infection. This system, combined with chemical control, is used in Field VIII, where the spread of rootrot had to be kept at a minimum. The cut weeds are used as mulch.

5. Smothering

Weedgrowth is suppressed either by mulching or by growing cover ground crops such as Desmodium CV greenleaf. On Fiel II, block 6, heavy pruning of the old umbrella-shaped coffee trees was carried out.
The sudden increase of ligh intensity provoked heavy weedgrowth which was controlled by 2 rounds of spraying Roundup.

After killing the weeds a light soiltillage was carried out and pre-inoculated seed of Desmodium CV greenleaf with nitrogen fixing, Rhizobium bacteria, was sown.

As soon as the soilcover was established (spottreatment and resowing were necessary) it was regularly slashed back, and around the trees the soil was kept weedfree by handpulling and mulching.

The system is effective but preliminary inputs are high.

Chemical control

The use of herbicides has some clear advantages such as :

- Selective herbicides reduce the need for handweeding and cultivation that often cause rootdamage.
- Herbicides often offer the only possibility of effectively controlling persistent perennial grasses such as Imperata cylindrica and Cynodon dactylon.
- The use of pre-emergence herbicides for intercrops.
- Certain herbicides offer the possibility of minimum or zero tillage and thus preserve the soilstructure and diminish the danger of soil erosion.
- Herbicides are cost-effective, where labour is expensive and scarce.

However the dangers and aventual disadvantages can be summarized as follows :

- Most herbicides are toxic and increase the danger for man and environment.
- In case the same herbicide is used repeatedly the weeds which are resistant to that herbicide will thrive and spread.
- Practical problems such as availability of proper equipment and water at the spot.
- Certain herbicides can affect the flavour of coffee.
- Some herbicides cannot be used on young coffeeplants.
- Frequent use of herbicides under coffeetrees can cause phytotoxity as the feederroots are near the soilsurface.

Trials carried out

The agronomy section carried out some minor trials as far as pre-plant and post-emergence treatments are concerned on the Fields I, V, VIII and IX.

After uprooting the old coffee, lamtoro and other trees the fields were leveled and left fallow for a couple of monhs, except Field IX, where the fallow period was about one year.
The regrowth of weeds was sprayed with a systemic weedkiller Roundup (glyphosate) which is translocated down into the roots of perennial weeds. This herbicide is highly effective but also quite expensive. Six hours of dry weather are necessary after spraying to permit absorbtion of the chemical. This restricts its use in the rainy season. Round-up is particularly effective against the perennial grasses "alang-alang" (Imperata cylindrica) and "rumput lembu" (Cynodon dactylon). For post-emergence treatment this herbicide was not used on very young coffee because of its systemic translocation into the rooting-system. Using a wick-applicator could solve this problem, but this equipment is apparently not available in Indonesia.
After lay-out, planthole digging and transplanting the coffee seedlings, deep-tillage by hand-hoeing was carried out to loosen the topsoil. Regrowth of weeds, mainly pioneer broad-leaved weeds, was further controlled by handweeding and mechanical weeding. It appeared that repeated slashing encourages the spread of grasses. During the next dry season the lower primary branches of the young coffee were removed or pruned-back to enable spraying with the contact herbicide Gramoxone (paraquat), a much cheaper product as compared to Roundup.
Small annual weeds are controlled but only the green tops of perennial grasses are affected and they soon grow back from the roots.
As there are no soil residues from gramoxone it can be used repeatedly at short intervals without causing phytotoxity to the coffee. However it should be prevented that leaves and other green parts suffer contact with this chemical. Timing of spraying was often hampered because of unpredictable weather conditions.

Conclusions and recommendations

- Traditional weedcontrol is highly insufficient especially before transplanting and during establishment of young coffee.
- Improved landclearing including pre-plant spraying of systemic weedkillers and intercropping with a rotation of crops which do not interfere with coffee, results in a uniform coffeegarden with higher production and lifetime of the bearing trees.

- The system of deep-hoeing should be discouraged between full bearing trees as the feederroots are damaged, increasing the risks of soil-borne diseases and soil erosion on steep land.
- Slashing of weeds should be carried out before flowering to prevent weedinfection. The cut weeds must be used as mulch around the coffee-trees to smother further weedgrowth.
- Repeated mechanical slashing encourages the spread of grasses. The system should be combined with light hoeing or eventual chemical weedcontrol. If light hoeing is carried out on steep land, the cut weeds should be collected into rows along the contourlines to increase waterinfiltration and to avoid soil erosion.
- Handpulling or ringweeding is recommended three times a year just before fertilizer application, especially during the first three years after transplanting.
- On marginal land, because of steepness, where intercropping should be discouraged or even prohibited, special attention should be given to pre-plant spraying of systemic weedkillers and the use of covercrops. Once the covercrop is established regular hand or mechanical slashing will provide abundant mulch material.
  The system has the advantages of improvement of soilstructure, fertility and soilconservation. It also offers the advantage of gradually making terraces on newly opened land or replanted coffeegardens where the young plants are planted along the contourlines.
- The choice of a certain weedcontrol system or a combination of systems depends on :
  - coffee cultivars used
  - age of coffeetrees
  - cultural practices eg. plantdistance and pruningsystem
  - erosion risks
  - type of prevailing weeds
  - labour availability
  - availability of other inputs
  - costs involved
  - intercropping during establishment period
  - covercrops and/or temporary-and/or permanent shade used.

For future research

The system of weedcontrol with minimum or zero tillage on moderate to steep slopes, using contact weedkillers, should be investigated. Weather-conditions might be a limiting factor, especially during the first year when 8-10 rounds are necessary. Once the weedpopulation is reduced, the requirement may be lowered to 4-5 rounds. Occasional spottreatment of persistant perennial grasses with systemic weedkillers may be necessary as well. This system should be tested in Field VIII or IX.

An integrated approach offers more possibilities for the short term planning as this could be more applicable toward farmers. A combination of mechanical and cultural weedcontrol (handpulling, hoeing, tillage during establishment period and smothering by mulching) combined with chemical weedcontrol (during the short dry period) could be investigated on farmers fields with bearing coffeetrees and newly opened land. To test dwarftypes the system should also be applied in Fields VIII and IX, and in the Jaluk area.

For longterm planning the following points are to be investigated :

- Effects of weeds
  - competition for mineral nutrients, sunlight, water and space
  - parasitism of certain weeds
  - incidence of pests & diseases
  - reduction of production and quality
  - interference with other cultural activities
- Inventarisation and characteristics of weeds
  - classification of weeds
  - occurrency of weeds and limits of distribution
  - survival of weeds
  - reproduction and dispersal of seeds
  - dormancy and germination
- Mode of herbicidal action
  - classification of modes of action
  - selectivity of herbicides
  - degradation of herbicides in the soil
  - timing of application
- Spraying technics
  - calibration and testing of equipment
  - calculation for application
  - maintenance

ESTIMATION OF AGE AND AVERAGE OF
COFFEE PLANTATION IN ACEH TENGAH
(1988)

DAFTAR : ANGKA PERKIRAAN LUAS DAN UMUR TANAMAN KOPI
DAERAH TK.II ACEH TENGAH THN 1988

NO.	K E C A M A T A N	AGE GROUPS KOMPOSISI UMUR (TAHUN)								TOTAL NO OF HA'S	
		0-3 years	.	3-10 years	.	10-30 years	.	>30 years		LUAS (HA)	
01	KOTA TAKENGON	123 ha	9,9%*	78	6,3	156	12,5	886	71,3	1.243 ha	3,8%
		3,5%**	-	50	-	4,4	-	37	-	-	-
02	BEBESAN	138	3,1%	300	6,8	612	13,8	3.381	76,3	4.431	13,5
		3,9%	-	19,0	-	17,2	-	14,0	-	-	-
03	PEGASING	165	7,6	104	4,8	1.334	61,4	571	26,2	2.174	6,6
		4,7	-	6,6	-	37,5	-	2,4	-	-	-
04	SILIH NARA	100	2,6	188	4,9	250	6,5	3.325	86,0	3.863	11,8
		2,8	-	12,0	-	7,1	-	13,8	-	-	-
05	L I N G E	327	62,3	10	1,9	14	2,7	174	33,1	525	1,6
		9,3	-	0,6	-	0,4	-	0,7	-	-	-
06	B U K I T	30	1	148	5	196	6,6	2.598	87,4	2.972	9,1
		0,9	-	9,4	-	5,5	-	10,8	-	-	-
07	TIMANG GAJAH	339	11,7	128	4,4	171	5,9	2.261	78,0	2.899	8,9
		9,7	-	8,1	-	4,8	-	9,4	-	-	-
08	B A N D A R	2.118	16,1	554	4,2	737	5,6	9.779	74,1	13.188	40,3
		60,4	-	35,2	-	20,7	-	40,5	-	-	-
09	BINTANG	169	11,6	65	4,5	86	5,9	1.135	78	1.455	4,4
		4,8	-	4,1	-	2,4	-	4,7	-	-	-
	J U M L A H	3.509	-	1.575	-	3.556	-	24.110	-	32.750	-
	% T O T A L	10,7	-	4,8	-	10,9	-	73,6	-	-	-

Sumber : Dinas Perkebunan Daerah
Source TK.II Aceh Tengah

* % of total per kecamatan
** % of total no. kecamatan per age proup.

The composting of coffeepulp

General situation

Homeprocessing is practised in the whole coffee area and the pulp is spread in the nearby gardens directly or after a rotting process

Trials and results

During the first coffeecampaign of the LTA Processing Unit in 1986/87, the huge amounts of pulp were piled up in and around the pulppit. It was observed that the timespan for decomposting was extremely short because of an anaerobic condition. It developed a bad smell and severe insect proliferation.

Land disposal of fresh pulp into coffeegardens was tried on the Project compount (Field IV and VI). When evenly spread and not too close around the mainstem of the coffeetrees no adverse effects were observed. The pulpmulch layer suppresses weeds and when mixed with the topsoil decomposes quickly.
Labourcosts however are very high and when wrongly applied, in too big quantities, it can damage the trees through acid formation and local heat generation.

Some small scale trials were set-up to find out a system of an efficient aerobic composting operation.
The first trials where the pulp was put into heaps and aircirculation was applied by means of perforated pipes, were unsatisfactory. The pile became too compact and anaerobic conditions prevailed.

No time for further trials was left during the second campaign as the problem for the factory of how to dispose of the pulp, demanded a quick solution.

No suitable place was available on the Project compound and the Agronomy Section reserved a location on Field VIII.
It was decided to test the system of windrow-composting on a large scale. Every day the pulp was piled into long heaps of approx. 1 meter high by 1 meter wide at the top and 2.5-3 meter wide at the base. Fresh coffee-

pulp contains more than 75% water and heaps become sodden and closely packed, producing an acid and anaerobic fermentation.
To increase aeration and pH and to decrease moisture content the pulp was mixed with dry parchment skin and lime (500 kg pulp + 14 kg parchment-skin + 2.5 kg lime). Aeration was maintained by turning the pile every week.
Results were very satisfactory. Within 3 months, depending on weather-conditions, the pulp was decomposed. It was calculated that about 5.5 tons of cherries produced 2 tons of pulp and approx. 1 ton of compost. Costs of labour + lime were estimated on Rp. 5000/m^3.

During the third campaign the compostinglocation was moved to Field IX, where a bigger area, 30 by 25 meter, was created. Two sideroads facilitate unloading of pulp and loading of compost.
The system met the requirements but heavy rainfall, producing poluted seepage-water, remains a limiting factor. The poluted water can cause considerable damage to crops nearby if not properly drained off.

The compost is being used for the soilmix to fill polybags in the coffeenursery.
First samples of the compost are being analysed.

Recommendations:

- Roofing the composting area on Field IX is a must if permanently used for large scale compostproduction.
- The future Research Station could start trials to identify the most economic and efficient way to produce a high quality compost, including treatments as watercontent-control by roofing, the application of parchment skin to improve structure and aeration, the application of lime and/or urea to improve pH and speed of decomposting.

FULL ANALYSES, CUP-TESTING AND DESCRIPTION OF COFFEE SAMPLES BY D.A. FRIES, COFFEE CONSULTING (14-6-1988)

Varieties*	1 B&D	2 TT	3 J	4 SK	5 R	6 S288	7 CPU	8 UL
Criteria								
RAW								
- Beansize**								
Conversion Bambu/weight	1.28	1.24	1.29	1.29	1.34	1.32	1.32	-
% Parchment	21	20	20	21	19	16	18	-
> 6,5 mm	91	78	80	92	90	82	89	85
< 6,5 mm	1	1	1	1	1	1	1	1
Elephant beans	1	5	2	1	0	3	0	2
Pea berries	1	7	9	1	3	2	2	4
Triangle shapes	2	1	3	1	1	2	2	2
Triage (T)	4	8	5	4	5	10	6	6
- Colour								
1. Blue Bluish		x	x					
2. Green Blue	x			x	x	x	x	
3. Pale Blue-Grey					x			
4. Grey-Green								x
5. Green/Greenish								
6. Yellowish/Lightish								
7. Light Brown/Brownish								
8. Brown								
9. Black								
- Centre cut								
1. Very closed			x					
2. Closed	x	x		x		x	x	
3. Slightly open					x			x
4. Open								

REMARKS : No. 8 UL - Slightly Brown cut and fruity smell.
Acc. to D.E. 30-1-1988 fermented odour!

	1 B&D	2 TT	3 J	4 SK	5 R	6 S288	7 CPU	8 UL
ROAST								
- Roast appearance								
1. Fine	x		x	x	x	x	x	
2. Good		x						
3. Fair								x
4. Poor								
5. Not uniform								
- Centre Cut								
1. White Closed	x		x	x		x	x	
2. White Open					x			
3. Partly White		x						
4. Brownish								x
5. Brown								
LIQUOR								
- Acidity	5	3	1	3	1	2	3	5
- Body	4	4	4	4	4	4	4	4
- Flavour	3	3	1	3	1	1	1	3
- Defects in cups								
- Chemical	N***	N	N	N	N	N	N	N
- Grassy	"	"	"	"	"	"	"	"
- Earthy-woody	"	"	"	"	"	"	"	"
- Green	"	"	"	"	"	"	"	"
- Sour/Fruity	"	"	"	"	"	"	"	"
- Unclean	"	"	"	"	"	"	"	"
- Stinkers	"	"	"	"	"	"	"	"

Criteria :
1. Very Good Rich
2. Very Good Light
3. Good
4. Heavy
5. Mild
6. Light
7. Strictly Soft
8. Soft
9. Minas
10. Rioy
11. Sharp

REMARKS :
3 J. Acidity may be to strong.
5 R. Especially good, fruity taste, very good.
Acc. D.E. 30-1-1989, all samples lacking somewhat body!
3 J. somewhat aromatic
8 UL. somewhat pulpish and fermented flavour

* 1. B&D - Berg en Dal
2. TT - Timtim (HdT)
3. J - Jaluk (Catimor HW26)
4. SK - Sidi Kalang
5. R - Rambung (Abyssinia)
6. S288 - S288 Indian (interspecific Hybrid)
7. CPU - Central Processing Unit PDGM coffee
8. UL - Untreated Local (semi-washed!)

** Beansize determination by Laboratory LTA/Agro-Research (25-4-1988)

*** N = None

Pondok Gajah, 30-5-1989.

Note: The test is once-only and should be repeated several times for a couple of years before final conclusions can be drawn.
Each buyer has different standards of criteria which makes an evaluation more complicated.

INVENTORY IMPROVED PLANT MATERIAL
MAY 1987 - MARCH 1989

From :	Generation F..	Date receipt of seed	Transplanting date	Number of plants	Location	Number of plants affected after screening total no.	no. affected	%	Remarks
1. THAILAND ex Kenya									
H. 306/1	*F5	Mai 1987	Feb. 1988	2.496	Field VIII Bl.2	-	-	-	Still screening in the field
P. 88	F5	Feb. 1988	Feb./March '89	5.750	Field IX Bl. 1-3-4-5	8.792	702	92%	
H. 528	*F4	Oct. 1988	(sept. 1989)	2.000	-	-	-	-	Not yet screened.
				10.246					
2. AUSTRALIA/ QUEENSLAN ex Portugal									
c. 41	F7	Dec. 1987	Oct. 1988	2.424	Field VIII Bl.3	1.105	0	100%	In the field
		" "	March '89	100	Field IX Bl.2			"	not yet screened.
c. 47	F7	Dec. 1987	Oct. 1988	2.658	Field VIII Bl.4	1.424	5	99%	"
		" "	March '89	100	Field IX Bl.2			"	
c. 48	F7	Dec. 1987	Oct. 1988	2.771	Field VIII Bl.5	1.406	3	99%	"
		" "	March '89	150	Field IX Bl 2			"	
c. 49	F7	July 1988	(June'89)	250	Field VIII Bl.7	-	-	-	Not yet screened.
		" "	(June'89)	50	Field IX Bl.2			"	
c. 50	F7	Dec. 1987	Nov. 1988	2.555	Field VIII Bl.6	1.606	3	99%	In the field
		" "	March '89	180	Field IX Bl.2			"	not yet screened.
				11.208					

* Crossed back Catimors
others are true Catimors

From :	Generation F..	Date receipt of seed	Transplanting date	Number of plants	Location	Number of plants affected after screening total no.	no.affected	%	Remarks
3. P.N.G. ex Portugal									
NG 7468 I	F4	July 1988	(sept. 1989)	696	No land avai lable sofar	-	-	-	Not yet screened
NG 7468 II	F4	July 1988	"	824		-	-	-	"
NG 7361	F4	July 1988	"	480		-	-	-	"
NG 7359	F4	July 1988	"	670		-	-	-	"
NG 7364	F4	July 1988	"	524		-	-	-	"
				3.194					
4. BRAZIL ex Brazil x Portugal									
1. C.1669-20 (cova 285)	F3-4	Dec. 1987	(April 1989)	15		15	0	100%	Not yet trans planted
2. C.1669-33 (Cova 1)	F3-4	Dec. 1987	"	20		20	0	100%	"
3. C.3020- 2 (Cova 76)	F4-5	Dec. 1987	"	47		47	46	2%	"
4. C.3011- 1 (Cova 141)	F5	Dec. 1987	"	40		40	0	92%	
5. C.1669- 3 (Cova 496)	F3-4	Dec. 1987	"	28	Field II B1.6	28	0	100%	
6. C.2967- 8 (Cova 318)	-	Dec. 1987	"	48		48	0	100%	
7. C.3009-3 (Cova 183)	-	Dec. 1987	"	40		40	0	100%	
8. C.2967-4 (Cova 118)	F4-5	Dec. 1987	"	43		43	9	79%	
9. C.2969-1 (Cova 31)	F4-5	Dec. 1987	"	47		47	1	98%	
10. Catimor Colecao	-	Dec. 1987	"	14		14	3	78%	

From :	Generation F..	Date receipt of seed	Transplanting date	Number of plants	Location	Number of plants affected after total no.	no.affected	%	Remarks
11. Catimor Colecao	-	Dec. 1988	(oct. 1989)	34	Field VII Bl.2	-	-	-	Not yet
12. C.3540-4 C.1996	-	Dec. 1988	"	85		-	-	-	screened
13. C.3548-3 C.1911	-	Dec. 1988	"	73		-	-	-	
14. C.3551-3 C.1667	-	Dec. 1988	"	77		-	-	-	
15. C.1669-33 C.2698	-	Dec. 1988	"	63		-	-	-	
				674					
5. INDIA ex India									
Cauvery	F6	March 1988	March 1989	110	Field IX Bl.2	227	0	100%	
S L N-9	F4	March 1988	"	112	Field IX Bl.3	230	3	98%	
6. INDONESIA ex Portugal									
Jaluk C.J. Catimor	-	March 1988	March 1989	928	Field IX Bl.2	2.191	0	100%	
Timor Timur C.T.T.	-	March 1988	Febr. 1988	770	FIELD VIII Bl.1	750	2	99%	
				1.698					
		Grand total :		27.242					

BACKGROUND INFORMATION ABOUT CATIMOR AND OTHER SELECTIONS

From Thailand:

H 306/1	F1 - HW 26/5 = Caturra Vermelho* CIFC 19/1 x 832/1 H.d.T.
	F2 - SL 28 x HW 26/5
	F2 (1083/9) was subsequently self-pollinated in the next generation to become the present F4 in Thailand.
	SL 28 - a Kenya single tree selection made in 1935 from a commercial cvs. not quite a heavy yielder but a particularly fine liquor.
	F5 - generation is present at the CDC, Aceh Tengah.
P(rogeny) 88	F1 - Caturra x CIFC 1343/269.
	F1-F3 - from a Catimor breeding programme in Colombia.
	F3 - progeny of P 2030, Kenya.
	F4 - further selected in Thailand.
	F5 - generation present at the CDC, Aceh Tengah.
	In Kenya P 88 was found to be resistant to CLR and CBD (Coffee Berry Disease) with promising yields and high quality.
H 528/46 (Cavimor)	F1 - Catuai Amarelo** (2482/20) x HW 26/13
	HW 26/13 = Caturra Vermelho x 832/1 H.d.T.
	F2-F3 - further selected in Thailand.
	F4 - generation present at the CDC, Aceh Tengah.

** Amarelo = yellow beans

* Vermelho = red beans

From Queensland, Australia:

C 41	Costa Rica - Turrialba T 8660 (F6) originally from Universidade Federale de Viçosa (UFV) in Brazil.
C 47	Portugal (F6 mixture of seed from 14 group A plants of progeny CIFC 7960 (F5).
C 48	Portugal (F6 mixture of seed from 10 group A plants of progeny CIFC 7961 (F5).
C 49	Portugal (F6 mixture of seed from 3 group A plants of progeny CIFC 7962 (F5).
C 50	Portugal (F6 mixture of seed from 11 group A plant of progeny CIFC 7963 (F5).

Group A - Resistant to all the rust races of the CIFC collection.

CIFC 7960 (F5) progeny of the CIFC HW 26/5-3-45- 1 (F4)
CIFC 7961 (F5) " " " " HW 26/5-3-45- 6 (F4)
CIFC 7962 (F5) " " " " HW 26/5-3-45- 4 (F4)
CIFC 7963 (F5) " " " " HW 26/5-3-45-88 (F4)

HW 26 = Caturra Vermelho CIFC 19/1 x H.d.T CIFC 832/1

F1 generation selected at CIFC, Portugal.
F2 " " at IIAA-Investigaçao Agronomico, Angola.
F3 " " at UFV - Universidade Federal de Viçosa, Brazil.
F4 " " at UFV and EPAMIG-Empresa Agropecuaria de Minas Gerais, both in Brazil.
F5 " " at CIFC, Portugal.
F6 " " at RSW - Research Station Walkamin, Australia.
F7 actual generation at CDC, Aceh Tengah.

Sofar very promising, uniform, greentipped, dwarf coffee with very low percentage of affected plants after CLR-screening.

From Papua New Guinea:

NG 7468 - I	Catimor T 5159 (HW 26 red Caturra x H.d.T.)
NG 7468 - II	All derivatives from HW 26/5-4
NG 7361 (H 419/20)	F3 - from PNG
NG 7359 (HW 26/5-4	F4 - actual present at CDC, Aceh Tengah
NG 7364 (H 420/10)	

From Brazil:

C 1669-20	Vila Sarchi x H.d.T.	F3-F4	(= Sarchimor)
C 1669-31			
C 1669-33			
C 2969-1	UFV 1603 Caturra x H.d.T.	F4-F5	
C 3020-2	Vila Sarchi x H.d.T.	F4-F5	(= Sarchimor)
C 2967-4	UCY 1603 Caturra x H.d.T.	F4-F5	
C 3011-1	UFV 27 Caturra x H.d.T.	F5	
C 3009-8	MK 136	F5	

Further information in detail has been requested by the CDC for the lines recently received from Brazil:

C 2967-8, Catimor Coleca, C 3540-4 C 1996, C 3548-3 C 1911, C 3551-3 C 1667 and C 3009-3.

From India:

Cauvery	F1 - CIFC HW 26 = Caturra Vermelho x H.d.T. (CIFC 832/1)
	The population is also called Catimor 45 which resulted from the hybrid CIFC HW 26. Selections of Catimor 45 were sent to India where the hybrid has been further selected and now released for commercial cultivation under the designation of "Cauvery". This genotype possesses high vertical resistance to CLR (85% of F6 recording A-reactiongroup to HV) coupled with high productive potential.

SLN 9

F1 - Tafarikela x H.d.T.

Tafarikela - Ethiopian origin, collected by P.G. Sylvain.
Planthabit and seed characters highly uniform. Branches horizontal, later dropping. Internodes short, medium; leaftips light bronze, occasionally green. Fruits oblong to long oblong. Beans long oblong. Progeny from selected plants under trial indicates high tolerance to CLR and drought hardiness and some tolerance to nematodes. Yield moderate. (Coffeeplanters guide, India 1974)

F3 - generation 90-95% of the population exhibits A-reactiongroup to HV.

F4 - actually present at CDC, Aceh Tengah.

From Indonesia:

C.J(aluk)

F1 - CIFC HW 26 (= Caturra Vermelho x H.d.T.) sent by CIFC to East-Timor in the late 1960's.

F2 or 3 sent to Aceh Tengah accidentally in a batch of Arabusta-Timtim seed.

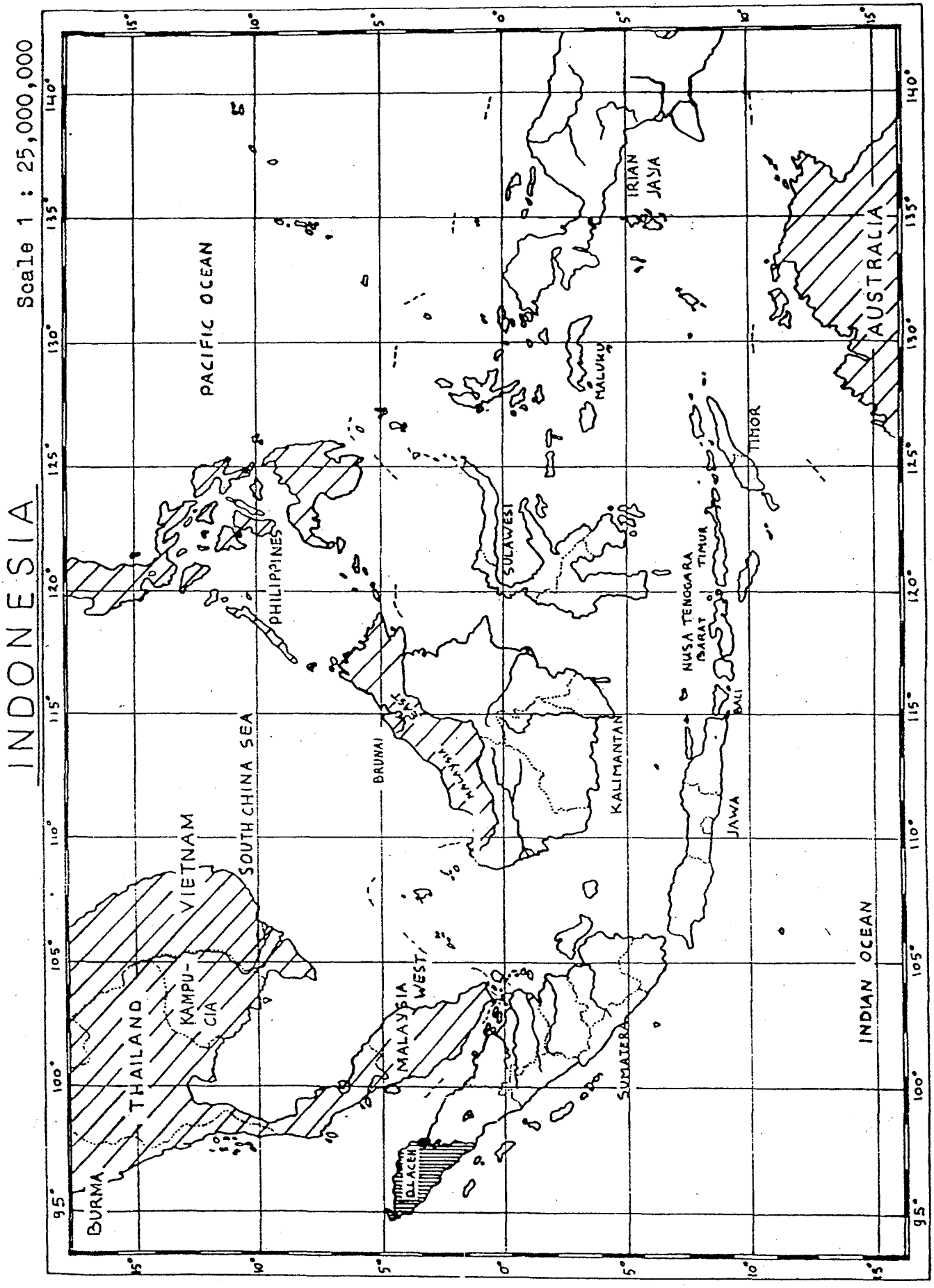
F3 or 4 Farmers seedgarden at Jaluk, Silih Nara, Aceh Tengah.

F4 or 5 actually present at the CDC, Aceh Tengah.

C.T(im)T(im)

sent by the Dinas Perkebunan Timor under the name of Caturra.
Later it was discovered that it is a real Catimor and probably a young generation as >50%.shows brown tips. After screening of 750 trees in the field only 2 showed symtoms of CLR.

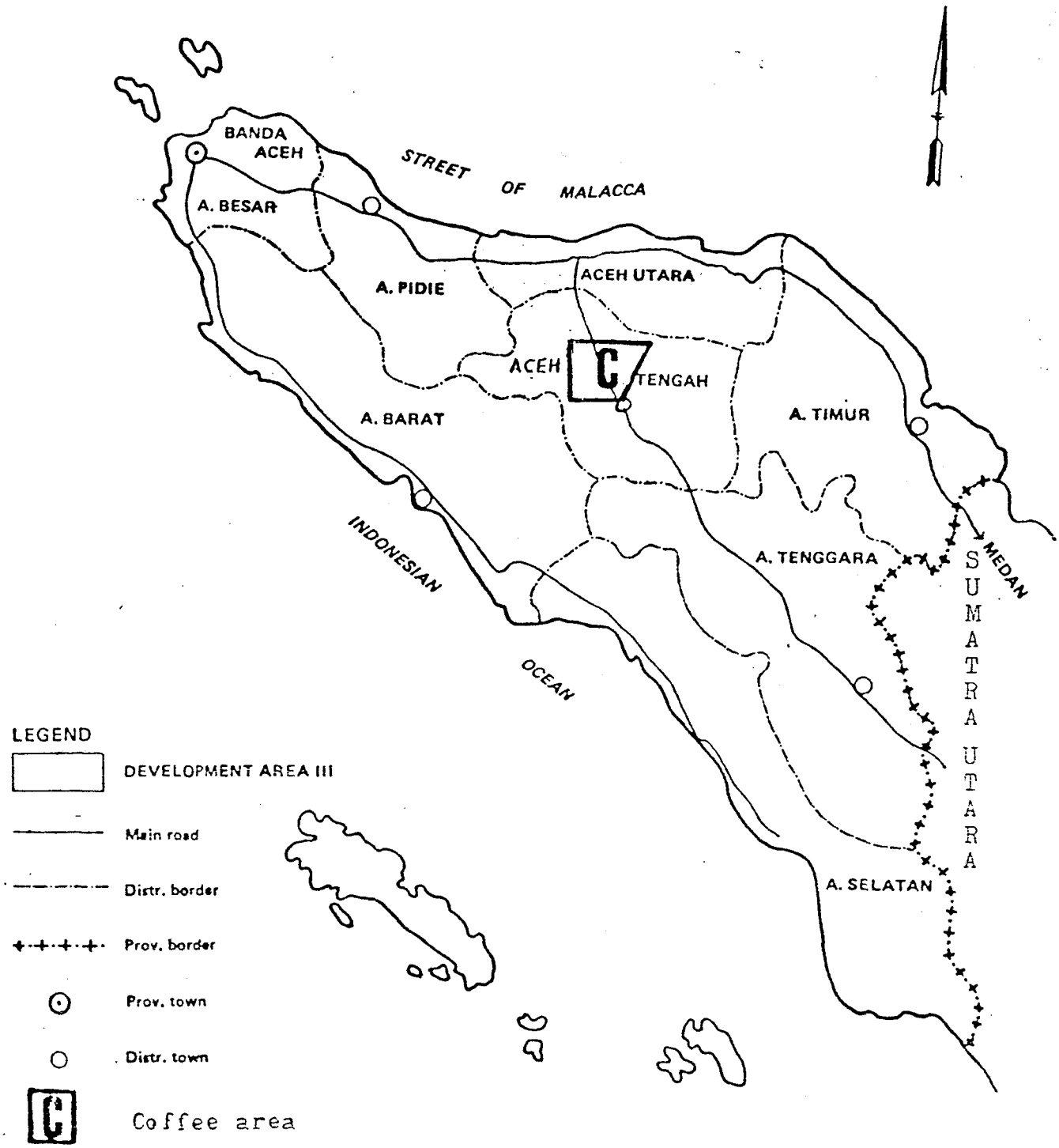
map I


INDONESIA
Scale 1 : 25,000,000
PACIFIC OCEAN
IRIAN JAYA
AUSTRALIA
MALUKU
TIMOR
PHILIPPINES
SULAWESI
NUSA TENGGARA BARAT
NUSA TENGGARA TIMUR
BALI
BRUNAI
KALIMANTAN
JAWA
SOUTH CHINA SEA
VIETNAM
KAMPU-CIA
THAILAND
BURMA
MALAYSIA WEST
SUMATERA
DI ACEH
INDIAN OCEAN
95°
100°
105°
110°
115°
120°
125°
130°
135°
140°
15°
10°
5°
0°

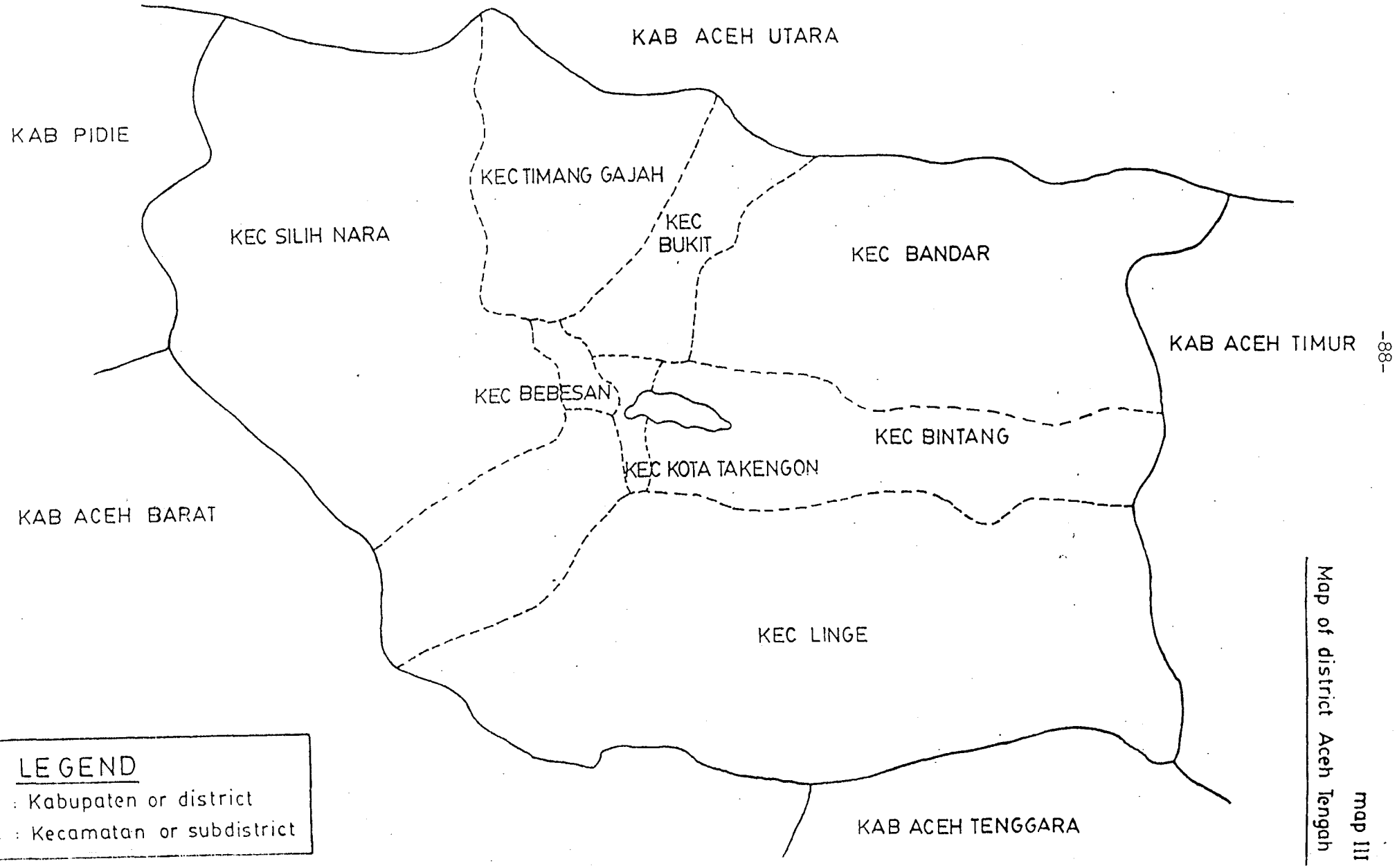
map II

MAP OF SPECIAL TERRITORY ACEH

Scale 1 : 2,500,000



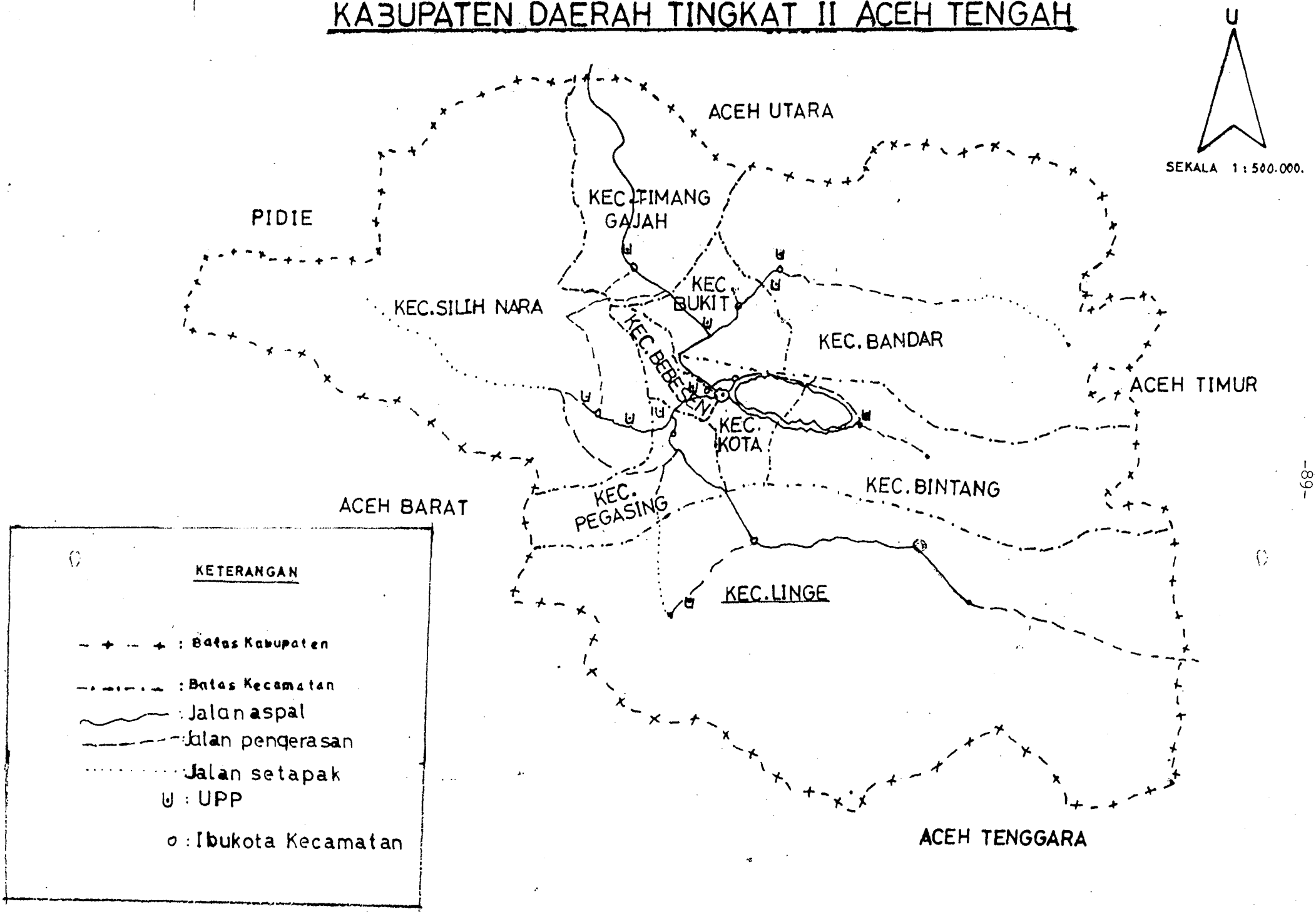
ADMINISTRATIVE BORDERLINES ACEH TENGAH DISTRICT



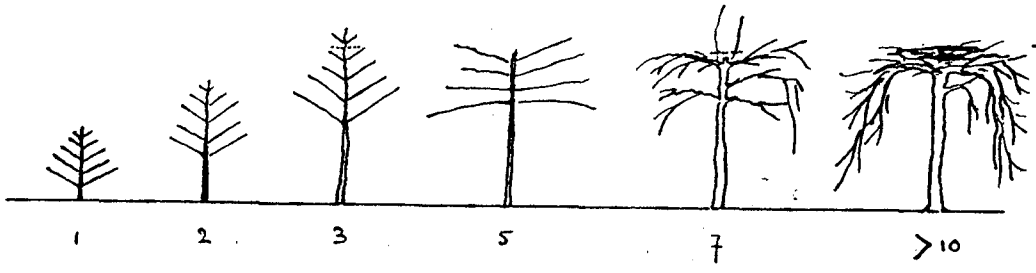
Map of district Aceh Tengah

map III

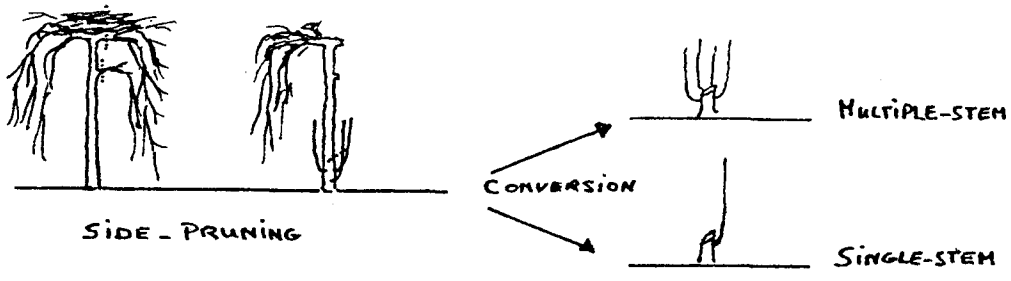
KABUPATEN DAERAH TINGKAT II ACEH TENGAH

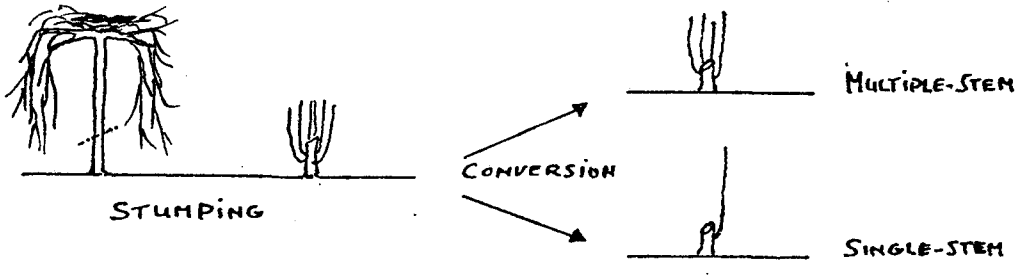


REJUVENATION - CONVERSION AND PRUNING SYSTEMS. I

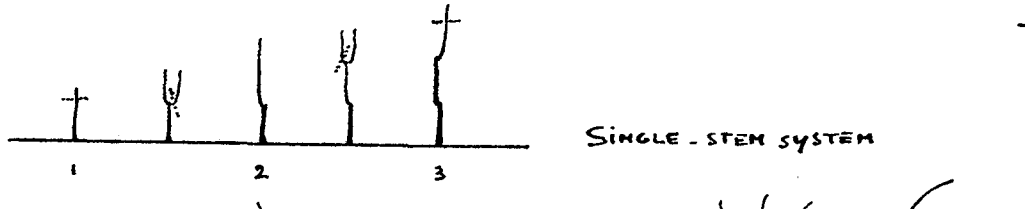


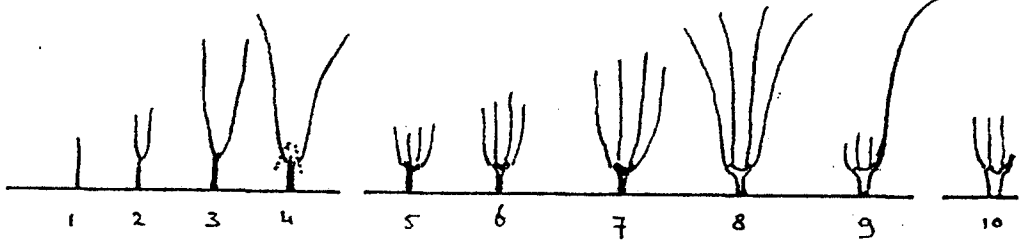
TRADITIONAL SINGLE-CAPPING/ SINGLE-STEM SYSTEM





OLD UNPRODUCTIVE COFFEE

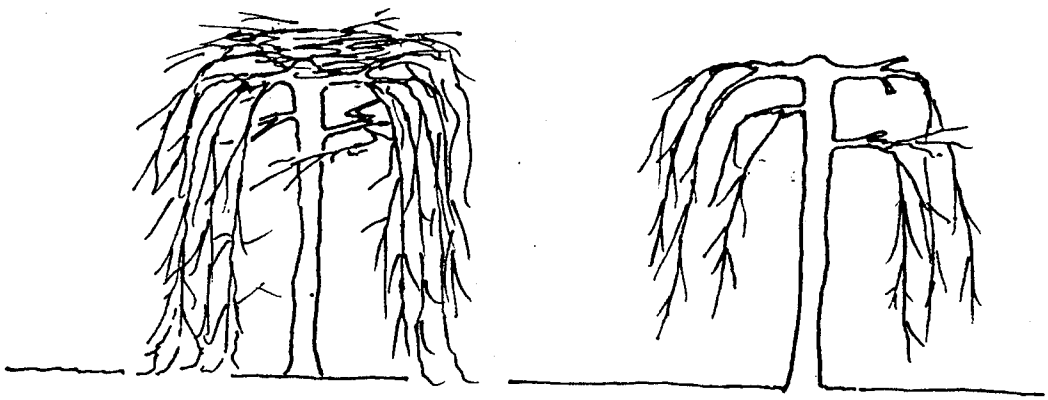




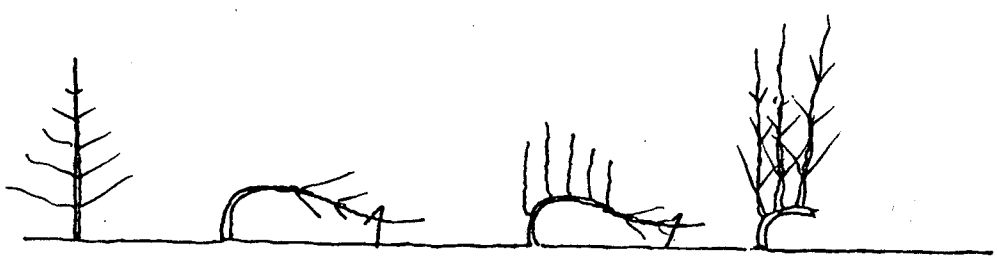
MULTIPLE-STEM RECYCLING SYSTEM

YOUNG COFFEE

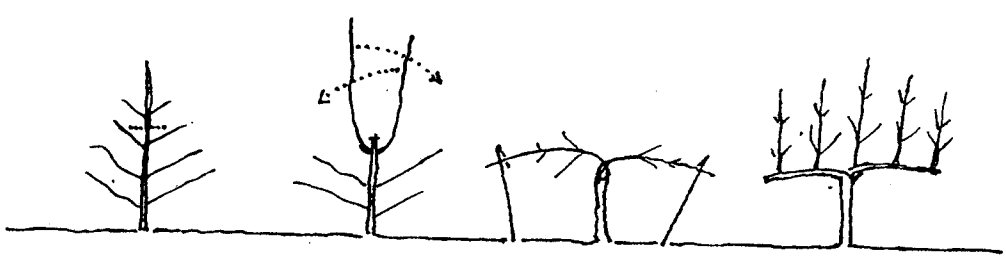
REJUVENATION - CONVERSION AND PRUNING SYSTEMS. II



HEAVY BACKPRUNING ACC. TO THE UPP-PK SYSTEM

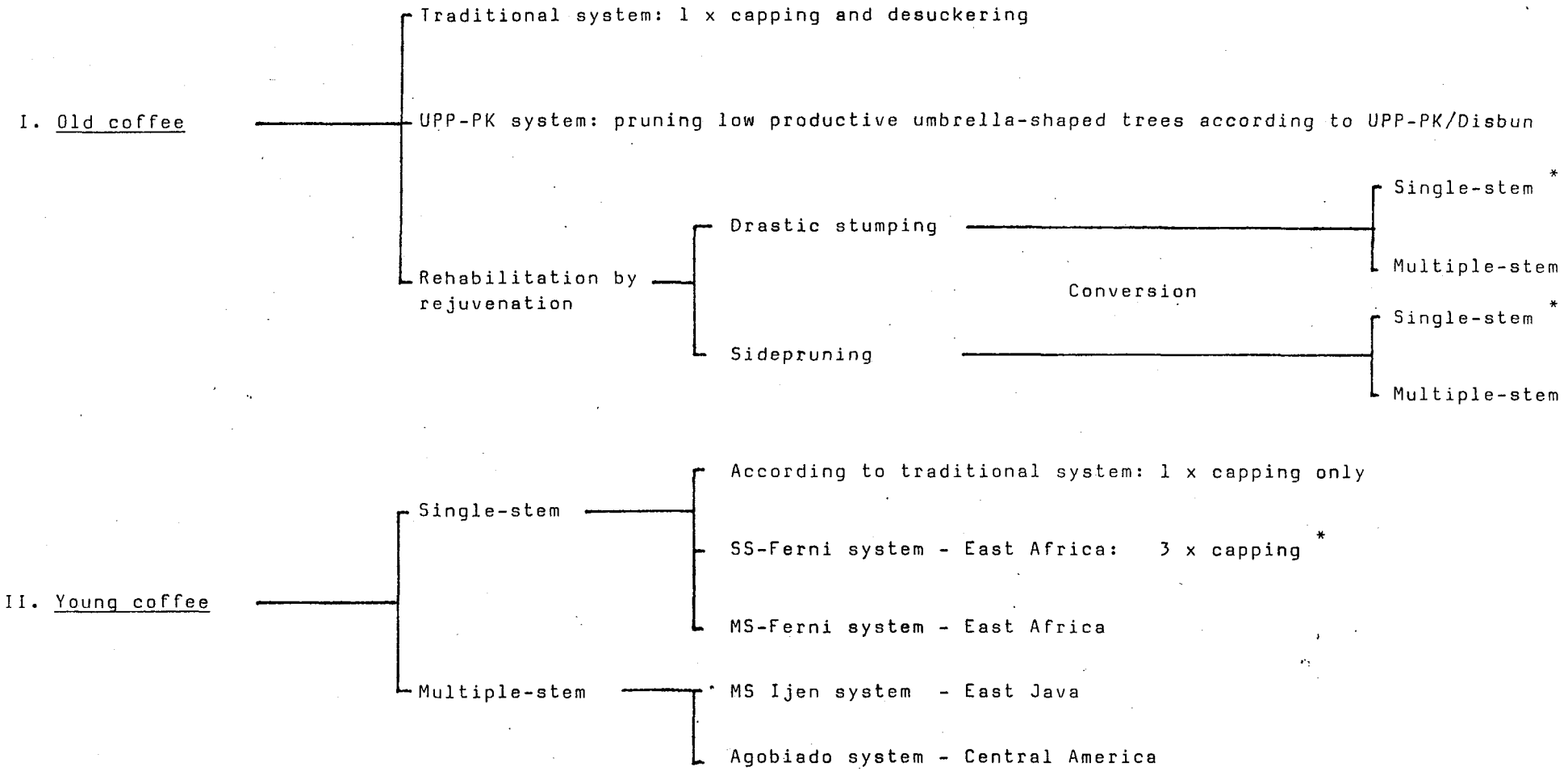


AGOBIADO SYSTEM



CANDELABRA SYSTEM
PRODUCTION OF CUTTINGS !

SYSTEM OF REHABILITATION AND PRUNING OF ARABICA COFFEE



* Maintenance pruning necessary. The system demands knowledge and skill.

CROPPING CALENDER OF COFFEE ARABICA

Main Activities	YEARS & MONTHS																																			
	1st year												2nd year												3th year											
	1 J	2 F	3 M	4 A	5 M	6 J	7 J	8 A	9 S	10 O	11 N	12 D	1 J	2 F	3 M	4 A	5 M	6 J	7 J	8 A	9 S	10 O	11 N	12 D	1 J	2 F	3 M	4 A	5 M	6 J	7 J	8 A	9 S	10 O	11 N	12 D
Pre-nursery	xxxxxxx																																			
Nursery				xxxxxxxxxxxxxxxxx																																	
Landpreparation					xxxxxxxxxxxxxxxx																																
Transplanting (coffee- & lamtoro sdls.)									xxxxxxxxxx																											
Weeding													xxx			xxx						xxx			xxx			xxx						xxx		
Light pruning (capping & desuckering)																xx						xx			xx			xx						xx		
Fertilizer application																xx						xx			xx			xx						xx		
Infilling													xxxx									xxxxxxxxxx														
Chemical weed control						xxxxxx												xxxxxx												xxxxxx					
Removal 1st crop (flower-picking!)																																				
	1 J	2 F	3 M	4 A	5 M	6 J	7 J	8 A	9 S	10 O	11 N	12 D	1 J	2 F	3 M	4 A	5 M	6 J	7 J	8 A	9 S	10 O	11 N	12 D	1 J	2 F	3 M	4 A	5 M	6 J	7 J	8 A	9 S	10 O	11 N	12 D
	4th year												5th year												6th year											
Weeding (hand- and/or mechanical)	xxx			xxx				xxx					xxx			xxx				xxx				xxx			xxx								
Chemical weed control						xxxxxx												xxxxxx												xxxxxx					
Pruning: - heavy (incl. lamtoro)						xxxx												xxxx												xxxx					
- light	xx			xx				xx					xx			xx				xx					xx			xx								
Fertilizer application	xx			xx				xx					xx			xx				xx					xx			xx								
Harvesting									x x xxxxx xxxx x x																											

Pre-nursery;

- seed collection & treatment
- seedbed preparation &
- soil treatment
- sowing
- watering/maintenance

Nursery;

- fixing overhead-shade
- filling poly-bags
- transplanting
- preventive P&D control
- fertilizer application
- weeding
- watering
- selection (screening)
- sun-hardening

Transplanting;

- plotting
- planthole digging
- compost application
- refilling
- transplanting
- sowing temp. shade

Aftercare;

- weeding (hand-, mechanical- & chemical-)
- pruning (heavy- & light or maintenance-)
- fertilizer application
- preventive & curative P&D control
- shade regulation
- erosion control

OCCURING PEST & DISEASER IN ACEH TENGAH
COFFEE ARABICA

Common and Latin name	Indonesia and/ or Gayo name	Part(s) of plant affected and general description	Estimated % affected*	Degree of damage **	Measures of Control and/or prevention
1. Diseases :					
1.1 Coffee Leaf Rust (CLR) Hemileia vastatrix Berk & Br.	Karat daun	Mature leaves orange-yellow powdery spots on under-surface of leaf only but as leaf killed visible on upper surface. Spots run together causing loss of leaf area. Often heavy leaf fall causing overbearing & Die-back.	5	<1000 m.sd	Selection of CLR resistent cvs. chemical control by soil application.
1.2 Root Diseases Fusarium Spp a. Root rot Armillaria meleo(vahl) Ganoderma Spp. b. Black Root rot Rosellinia bunodes (Berk & Br) sacc. c. Brown Root rot Fomes Sp. Fusarium solani (mart) sacc.	Cendawan akar	Roots and collar general wilting and death of whole tree, roots show signs of decay. Spread slowly from leucaena to coffee and adjacent trees. Root and collar. Decay very close to ground, white mycelium under bark. Black rhizomorphs in vertical cracks. Fruiting body at tree base up to 0,5 m. wide, reddish brown shiny on top, white below with small pores. Fruiting body black crusty granular sheet at base of tree. Black strands of mycelium with irregular knots on root surface also penetrate cortex. Fruiting body hard, lowshaped, pores yellowish brown. Centre of trunk at soil level purplish pink stain.	1	sd	Improved land clearing practices : removal of stumps and roots. Avoid spread of infected spots uproot infected and adjacent trees and burn, Replanting after 2 yearS.
1.3 Brown Eye Spot Cercospora coffeeicola Berk & Couke.	Bintik-bintik coklat atau bercak cincin coklat.	Young and old leaves brown circular spots usually not more than 6 mm. in diameter Reddish brown border greying at centre with age usually a problem in nurseries only.	mature trees 1 seedlings 3-4	nd cd	improved cultural practizes. preventive spraying of Copper-fungicides.

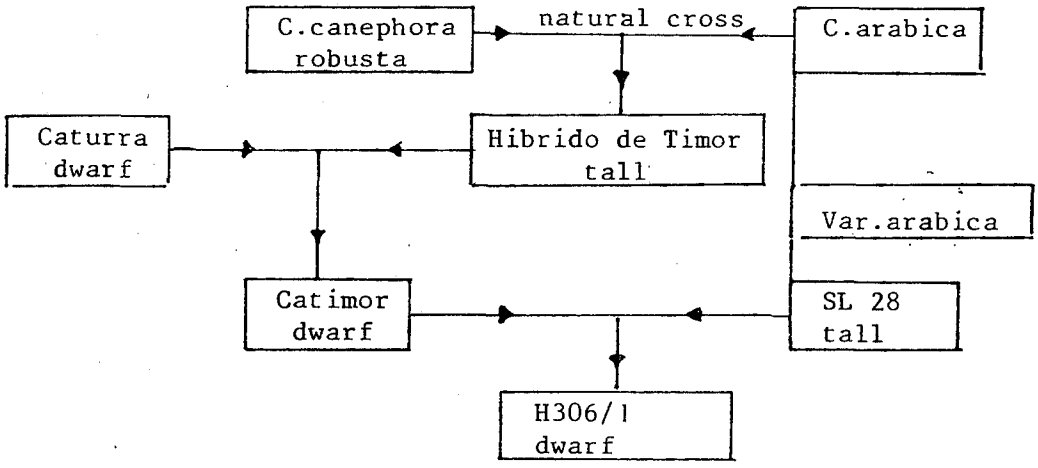
	Common and Latin name	Indonesia and/ or Gayo name	Part(s) of plant affected and general description	Estimated % affected*	Degree of damage **	Measures of Control and/or prevention
1.4	Leaf Blight (Ascochyta tarda)	Bercak daun besar	Young leaves and tips. Small lesions at tip or margin of the leaf. Lesions enlarge, forming concentric rings around initial section. Sometimes causing Die-back of young suckers.	from lower to higher altitudes 1-3	nd	no control recommended nursery as 3.
1.5	Damping off Rhizoctonia solani Phitium Spp.		Seedlings. The seedling up to four-leaf stage wilt. Collapse and decay. Stem constricted at ground level.	1-3	cd	sowing in Feb/March water control. Soil treatment.
1.6	Black mould (Capnodium citri)	Embun jelaga	Leaves and fruits. Crust of black mycelium on upper surface which disturbs photosynthesis The mould develops on honey-dew secreted by scales.	lower altitude 2-3	sd	see no. (2.2)
				higher altitude 1	nd	
2.	Pests :					
2.1	Coffee Berry Borer Hypothenemus hampei. Stephanoderes hampei Ferrari.	Bubuk buah kopi	Berries. Adult females (black ± 2,5 mm long), bore into the berries, entering at the tip. Eggs are laid in the tunnels (see Schuilink 1982).	lower areas 3-4	sd	frequent and off season picking, no mix-cropping with Robusta.
				higher areas 1	nd	
2.2	Brown Scale Saissetia coffeae	Kutu coklat	Branches and young tips. Immobile, greenish when young and brown when older, helmet-shaped insect, clustered mostly on shoots and somtimes on leaves and fruits. Often found together with green scale coccus viridis and mealy bug (Planococcus citri). association with ants, which attend the scale on the host plant to obtain Honey dew. Accumulated honey dew on leaves is later infected by fungi forming black mould (1.6).	young plants 2-3	cd	Avoid spread by ants with white oil-or grease banding or spraybanding of persistent insecticide and pruning lower branch touching the soil.
				old plants 1	nd	

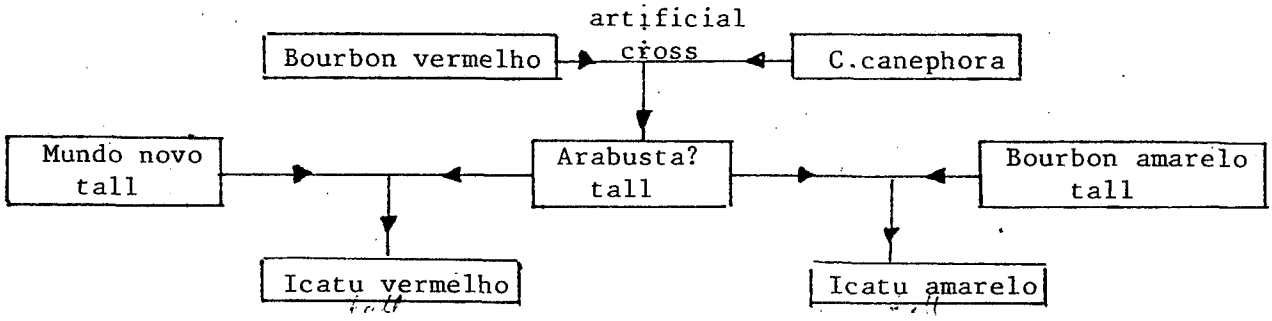
	Common and Latin name	Indonesia and/ or Gayo name	Part(s) of plant affected and general description	Estimated % affected*	Degree of damage **	Measures of Control and/or prevention
2.3	Loopers Geometridae	Ulat jengkal	Leaves. Various species are common. Easy to distinguish because of looping mition. Young caterpillar eats holes in the leaves and adults feed at the leaf edge all stages prefere flush leaves and sucker growth.	nurseries 3-4 plantations 1-2	cd sd	hand picking, sudden outbreaks using broad spectrum persistent, contact, non-phytotoxic insecticides.
2.4.	Stem-and branch borer Xylosandrus Spp Zeuzera Sp.	Penggerek batang	Part of plant show wilting. Hole(s) visible to exterior. Damage caused by tuneling	1	cd	Improved cultivation measures removal of affected parts.
2.5	Gelly grub Niphadolepin alianta	Sesongot	Old leaves are prefered. The caterpillar has an oval from and is translucent bluish green with yellow dats, young larva scrape from the epidermis leaving ribbon like tracks. Old larva feed at the edge of leaves. Sometimes ant breaks do accur.	1-3	sd	collect the larva and destroy.
2.6	Stinging Caterpillar parasa Spp	Ulat gatal	Bristle like caterpillar with stinging hairs young larva feed from under surface of leaves, the older feed from the edge of leaves.	1	nd	Protecting clothing during picking.
2.7.	Black aphids Toxoptera aurantii	Kutu hitam	Young leaves are attacked from under surface by the sucking aphids. Honey dew excretions cause settlement of fungi.	nursery plantations	cd nd	nursery : Control by spraying contact insecticide

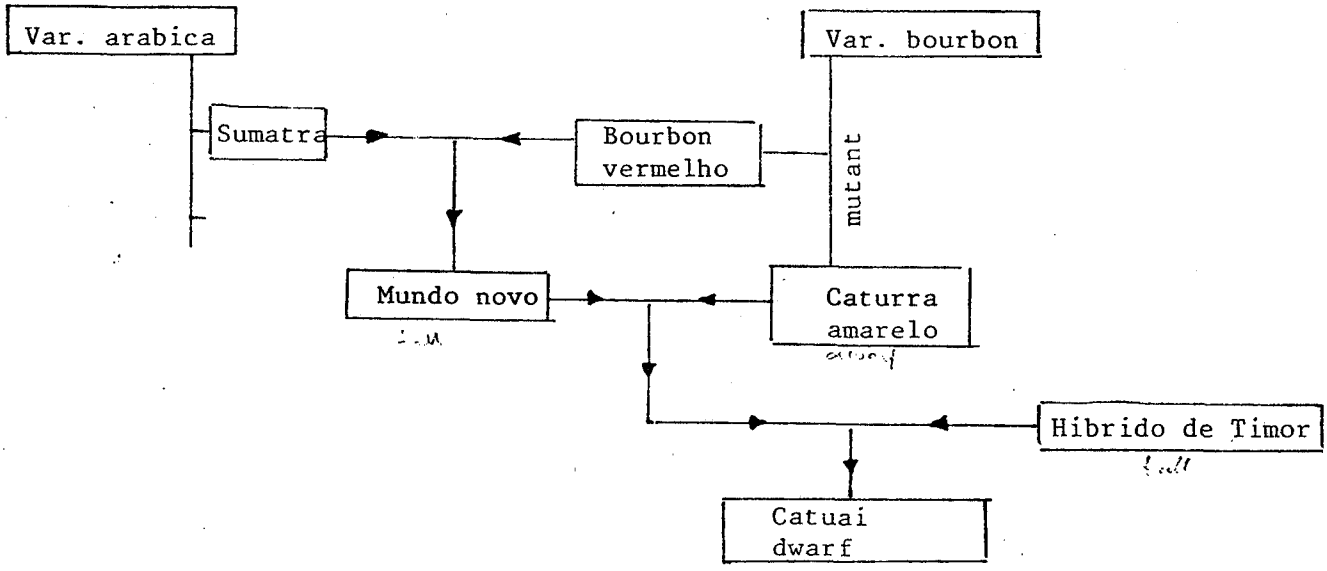
* Criteria : 1. : % affected 0 - 5%
2. : 5 - 10%
3. : 10 - 25%
4. : 25 - 50%
5. : 50 - 100%

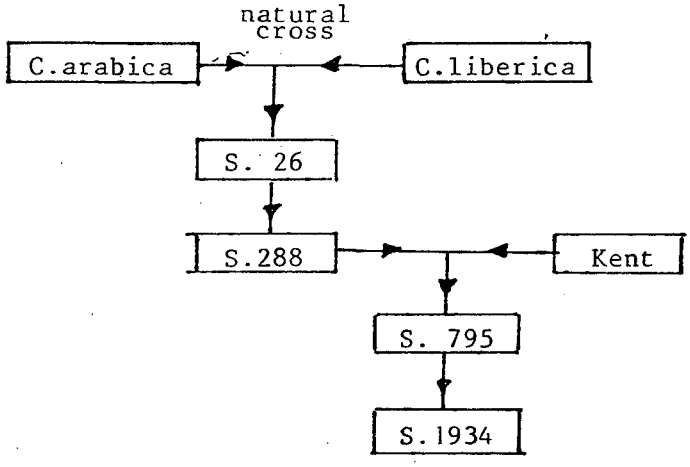
** Degree of damage : nd : negligible damage : control not necessary
sd : some damage : control not necessary or spot treatment
cd : considerable damage : control is recommended
sd : serious damage : control is urgent

CLR-resistant material








natural
cross
C.arabica
C.liberica
S. 26
S.288
Kent
S. 795
S.1934