Cirad / Tree Crop Department
Rubber Programme

Vietnam

Agricultural Diversification Project (ADP)
Technical assistance
on Rubber breeding experimentation
and recommendation of clones

December 2-18, 2001

André Clément-Demange

CP_SIC 1435
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Abstract

This mission of technical assistance on rubber breeding experimentation aimed at providing ADP project with clonal recommendations up-dated and fitted with the objectives of the project and the smallholders as main users.

It was realised by André Clément-Demange (a Cirad rubber breeding specialist) with 3 members of RRIV Breeding Group and with the Coordinator of the ADP Research Component, in December 2-18, 2001.

Around 30 different large scale trials have been visited in Lai Khê Centre (South), Central Highlands and Coastal Provinces from Nghê An province to Thua Thien Hué province. Data and observations have been discussed. First results of the mission have been jointly presented by the RRIV Breeding Group and the expert to ADP in Hué (December 14, 2001) and to RRIV in Ho Chi Minh City (December 17, 2001).

This report presents the final proposal of the expert for up-dated and more diversified clonal recommendations to be used by ADP project, as well as proposals for further experimentation and ideas for breeding.

Keywords

Vietnam, Agricultural Diversification Project, South, Central Highlands, Coastal Provinces, Smallholders, Rubber, ecological diversity, rubber cropping objectives, clonal experimentation, clonal recommendations, breeding methodology.

CONTENTS

EXECUTIVE SUMMARY

At the end of year 2001, ADP project has achieved the planting of 3,000 ha of new smallholders rubber plots in Vietnam, including 2,000 ha in year 2001, and plans to create 6,000 ha in year 2002.

Considering the target of 30,000 ha to be planted as well as possible future developments, the question of the choice of clones most suitable for the different ecological contexts and for the main objectives and constraints of smallholders is one technical element of rubber cropping systems. It is actually one relevant question to be tackled by the ADP Research Component.

The choice and the diversification of clones, as well as the choice of an adequate planting material (polybags, stumps of 2 or 1 year old), must also take into account the practical constraints of ADP project (budwood gardens management, production of budded plants, forecasting of areas to be planted in the next years, etc.) so as to optimise the implementation of the project.

Since 1985, RRIV has developped, within the course of its rubber breeding programme, a dense clonal experimentation network in the controlled conditions of Geruco farms and of some other institutions. This network is spreading in the main possible planting areas of Vietnam (South, Central Highlands, Coastal Provinces) and even in the northern province of Vinh Phuc near Hanoi. It includes Large Scale Clonal Trials (CT trials), Block Planting of different clones (XT trials), observation plots (QT trials), task-size plots of different clones and Small Scale Clonal Trials (ST trials). The network, with more than 50 % of the trials under tapping, makes possible the evaluation of more than 40 important clones : it appears as a very efficient tool for adapting clonal recommendations to the needs of ADP project.

At the time of the mission (December 2001), a full set of the main useful data related with the trials and updated at the date of November 2001, has been provided to the expert by the RRIV Breeding Group. The expert underlines the high quality of this long lasting work made by RRIV and the benefit that can be drawned from it by ADP project.

From December 3 to 15, the mission visited most of the clonal trials in the South (RRIV Lai Khê Centre), in Central Highlands (Krong Buk, Chu Prong, Chu Se, Mang Yang, Kon Tum, Plei Can, Geruco and Military companies) and in Northern Coastal Provinces (from Vinh to Hué). Trials CTDC86, XTDC86, XTDC94 (Duc Co) and CTEL97 were not visited but the related data were used for the evaluation of clones.

Around 225 different clones could be observed, more or less, over around 30 trials planted between 1985 and 1998 (25 large scale trials and 5 small scale trials) within the framework of the experimental network. Among them, our main attention focussed on 60 clones (12 + 18 + 6 + 24), taking into account their potential interest and the level of available information about them. Many papers written by RRIV (Vietnamese and English language) are providing tables and synthesized informations about the results of these trials (cf references).

The mission also visited Chu Prong station in Gia Lai and took the opportunity to visit the ADP research (Chu Prong in Gia Lai province and Huong Tra in T.T. Hué province) about the intercropping of inter-rows for food, cash and cover crops associated with farmer's income during the immaturity period, prevention of Imperata development and management of soil fertility with potential long term benefit to rubber.

The mission also took the opportunity to observe some smallholders' plantations issued from Project 327, with different cases of intercropping, in Kon Tum, Nghê An, Quang Binh, Quang Tri and T.T. Hué provinces, as well as two budwood gardens.

First results of the mission have been jointly presented by the RRIV Breeding Group and the expert to ADP in Hué (December 14, 2001) and to RRIV in Ho Chi Minh City (December 17, 2001).

CLONAL RECOMMANDATIONS

✏ **The recommendation of clones** has to take into account the differences between **4 ecological areas** (South, favorable areas of Highlands, less favorable areas of Highlands, Coastal Provinces) and the socio-economic context of ADP project :

- smallholders require clones with maximum security
- the project cannot multiply and deliver too many different clones at the same time
- the increasing importance of rubber wood leads to some reduction of the economic lifespan of the plots with the need for fast growing and fast yielding « latex-timber » clones.

✏ In the last period of the mission, **a first proposal** for clonal recommendations to ADP project was jointly formulated by RRIV Breeding Group and the expert, based on the following 12 clones :

GT1, RRIM600, PB235, PB255, PB260, RRIM712, RRIC100, RRIC110, RRIC121, RRIV2, RRIV4, LH82/92

with following differentiation according to the ecologic areas :

Binh Thuan (South) : PB235, RRIV2, RRIV4 (class 1) + PB260, RRIC121 (class 2).

Central Highlands, favorable areas : PB260, RRIM600, PB235, RRIV4 (class 1) + RRIC121, RRIC110, RRIV2 (class 2).

Central Highlands, less favorable areas : GT1, PB260, RRIM600 (class 1) + RRIC100, RRIC110, RRIV2, LH82/92 (class 2).

Coastal Provinces : GT1, RRIM600, PB255 (class 1) + PB260, RRIM712, RRIV2, RRIC100 (class 2).

✏ Taking into account the fact that this proposal appeared too much diversified for the practical constraints of implementation of the project, and after having examined again all available data, **the expert is proposing the following 6 clones :**

GT1, RRIM600, PB235, PB260, RRIV2, RRIV4

with following differentiation according to the ecologic areas :

Binh Thuan (South) :	**PB235, RRIV2**	(+ PB260, RRIM600, GT1)
Central Highlands, favorable areas :	**PB235, RRIV4**	(+ PB260, RRIM600, GT1
Central Highlands, less favorable areas :	**PB260, RRIV4**	(+ RRIM600, GT1)
Coastal Provinces :	**GT1, RRIM600**	**(+ RRIV2)**

It is underlined that among these 6 clones, 4 have fast growth and may be considered as « latex-timber » clones (PB235, PB260, RRIV2, RRIV4).

✏ The case of **RRIC100** (tested only in 3 trials, not included in those recommendations) has been discussed. This clone appears to be resistant to many leaf diseases in the fields. Moreover, it is fast growing and visually attractive. But yield may be not higher than for GT1. Low grafting sucess rate may be a problem for implementation in the framework of a smallholders' project. Experimentation of this clone needs to be emphasized, especially at the level of smallholders' demonstration plots.

✏ The case of **RRIC121** (tested only in 4 trials, not included in those recommendations) has also been examined. As a fast growing clone, before and during tapping, this clone might be wind resistant and consequently fitted to Coastal Provinces. Yield is supposed to increase progressively. Experimentation of this clone needs to be specifically emphasized in wind prone areas, in controlled conditions as well as in multilocal farmers' plots, in a participative way.

✏ **RRIV2**, belonging to the 6 recommended clones, is growing very fast, yield is rather high and no sign of wind susceptibility has been observed yet. As a latex-timber clone with early opening (at least one year before GT1 and RRIM600), it can be used without any restriction in the South. We suggest to initiate its development in Coastal Provinces. We also suggest to compare 2 girth sizes for opening this clone: 50 cm (standard) and 55 cm (delayed opening, but not later than GT1 or RRIM600, with improved rigidity and better resistance to wind damage).

✏ RRIV2 and RRIC121 may be the 2 clones more able to improve performances with low risk in Coastal Provinces, when compared with GT1 and RRIM600. Conversely, PB235, PB260 and RRIV4 have to be strictly excluded in this area.

✏ **RRIV4**, with some proven susceptibility to wind damage, can be widely planted in Central Highlands.

✏ Among the clones examined, the following 15 clones can be considered as **« latex-timber » clones** due to their fast growth and to their architecture made of one main dominant stem with light secondary branches: PB235, PB260 RRIV2, RRIV4, LH82/92, PB312, PB330, IRCA130, IRCA230, LH82/75, LH83/152, LH83/290, LH83/732, LH88/61, LH88/241.

EXPERIMENTATION

➪ An important investment has been made for setting the existing clonal trials network. It is very important to continue collecting growth and yield data, as well as diseases observations (at least for 10-15 years) on all these trials so as to have a view which can be representative of the whole economic cycle. We must stress that continuing the collection of data over years for existing trials is very necessary for obtaining data-series on long periods of time and for long term evaluation.

➪ Introducing intensive stimulation in large scale clonale trials, after 3 to 5 first years of tapping is recommended, so as to be able to assess the specific behaviour of clones under stimulated tapping. This information will help to consider the reduction of tapping frequency (to d/4 or d/5) for reducing tapping costs and increasing profitability of the plots. Association of latex diagnosis to these stimulated trials will help to draw interpretation about the metabolic behaviour of clones. But introducing stimulation in the trials will require to adapt the production control system.

➪ Setting new clonal trials will be necessary for confirming the interest of RRIC100, RRIC121 and LH82/92, and for assessing new promising clones such as PB312, PB314, PB330, IRCA130, IRCA331, RRIV1, RRIV5, LH83/85, LH83/152, LH83/283, LH83/290, LH83/732, LH88/61 and LH88/241.

➪ Setting « smallholders'demonstration plots » for new recommended clones (PB260, RRIV2, RRIV4) will be one important way for making popular the « new » clones and for encouraging diversification from previous GT1 and RRIM600 clones.

➪ A specific experimentation would have to be developped, in controlled conditions, for assessing wind risk in Coastal Provinces and testing the possible positive impact of opening the trees at 55 cm girth for clones growing faster that GT1 and RRIM600.

⇨ A specific experimentation would have to be developped so as to compare the growth of 10 months old budded stumps with 20 months-old budded stumps, as well as to assess the effect of different levels of selection of stumps getting out of the nurseries, based on size and shape.

⇨ Some suggestions are given to the breeders for continuation of their work. And they are warmly encouraged to continue their very good work.

⇨ A statement is made on the need to choose a definite Vietnamese « easy name » for Vietnamese clones getting into large scale experimentation and beginning to be recommended and used by the planters.

Special thanks

Many thanks to the ADP project for requiring this expertise, organizing the meeting of December 14, 2001 in Hué, and thanks to the Scientific Coordinator of the ADP Research Component, Frank Enjalric for organising it and for his very active contribution to its success.

Many thanks to all our RRIV partners, thanks to Mr Mai Van Son, Director of RRIV for organizing the meeting of December 17, 2001 in Ho Chi Minh City, but more especially to the RRIV Breeding Group, including Mrs Trân Thi Thuy Hoa, Mr Lê Mâu Tuy and Mr Pham Hai Duong for their very active participation to the mission.

I must underline that all the data tables of the trials had been updated including records of October 2001, so just before my visit and ready to use. All these data were made available to me for examination, so considerably helping my work. RRIV is so demonstrating its ability to master the management of such an important experimental network all over the country. Thanks to Geruco Company for backing the experimental effort of RRIV.

Thanks to Mr Henk Zwindermann, ADP/PCU Rubber specialist, for discussions and advices related with clones and the implementation of the project.

Many thanks to Lê Gia Trung Phuc and Stephane Boulakia, belonging to the ADP research Component, for introducing me to the interest of fertility management of rubber-based multi-cropping systems, with the visit of an impressive and interesting experimental layout.

Agricultural Diversification Project
Cr. 3099-VN

TERMS OF REFERENCE
(Doc. RC-TR 11/01)

CIRAD Expert Mission
Agronomist and rubber breeding specialist
November 2001

1. Subject

Technical assistance on rubber breeding experimentation.

2. Context and background

- The Agricultural Diversification Project (ADP) aims to promote crops diversification and to increase the rural incomes through land allocation, long term loans, institutional strengthening and technical support with smallholder rubber cultivation.

- A smallholder rubber research programme exist, which is implemented by RRIV with the scientific support from CIRAD (Centre de Coopération Internationale en Recherche Agronomique pour le Développement), according to the convention signed between MARD and CIRAD and which includes two permanent CIRAD specialists and short scientific missions. This research component consists of three strategies: (i) basic research in controlled conditions, (ii) adaptive research under smallholder conditions and (iii) participatory research linked with the farmer's socio-economic environment.

- This project of rural development is based on rubber smallholders and agricultural diversification. Based on a good knowledge of the agro-socio-economic environment, it is envisaged to set up experiments enabling to identify the most adapted rubber cropping systems leading to a sustainable development in the future.

- According to the conclusions of the mid term review, the central and provincial authorities confirmed their strong commitment to the project of diversifying and intensifying agricultural production. The smallholder rubber development is limited by land availability and the indicative targets have been reduced to 30,000 ha. However, it is important and legitimate to assure the right choice of rubber planting material according to the environmental conditions. Some provinces will plant rubber this year and the following years, under sub-optimal conditions. Therefore the ADP needs support to establish criteria for land site and clones selection.

- A trials network has already been established by RRIV and CIRAD in the highland and coastal provinces in order to assess the potential of rubber cultivation in sub-optimal areas in term of agro-ecological conditions and rubber clones. There is a strong and long lasting partnership between these research organisms.

- Because the project is aimed to smallholder, it appears necessary, in accordance with the results of the trials network, to identify the most suitable rubber clones for small farmers.

3. Objectives of the mission

The research component needs to define the most suitable recommendations concerning the choice of rubber clones under various ecological situations.

Scientific support on rubber experimentation will include rubber experiments network monitoring and rubber development assessment in the highland and coastal provinces.

This mission of this rubber specialist, will allow, through the review of the trials already established and through field visits in both highland and coastal provinces, a global approach to field experiments in this area. The expert will check rubber experiments, especially breeding trials, and, according to the assessment of the results of RRIV experiments, will be able to propose relevant protocols and clonal recommendations.

Moreover, this could be also a chance to co-ordinate the approaches of both rubber smallholder extension and research components. This link could be useful in the future, therefore, discussions should be held with PCU rubber specialists and Mr Zwinderman should join the mission.

The mission will have:

. To visit and check the latest results of the trials established in the Highlands with focusing on breeding trials.

. To visit the first trials established at Chu Prong station,

. To visit the coastal provinces with the PPMUs, to assess the agronomic constraints of rubber cultivation in the area and the needs of research and experiments. Mr ZWINDERMAN, the PCU rubber smallholder specialist, should join the mission.

. To propose trials protocols according to the primary observations and conclusions.

<u>The overall objective is to propose new planting recommendations and to complete the programme of the ADP research component on farm trials regarding rubber breeding in the highland and coastal provinces.</u>

In accordance with these objectives, we can propose Mr. André Clément-Demange from (CIRAD-CP) as a CIRAD expert for this short term technical assistance with a single source appliance for the following reasons :

- Mr. André Clément-Demange has already an extensive knowledge of rubber growing in Vietnam through his involvement in the trials network monitoring and he disposes of the raw datas concerning the rubber clones behaviour in Vietnam.
- This knowledge and his known skills on rubber breeding make Mr. Clément-Demange as the right man to exploit in an efficient way the result of the network established by the partnership CIRAD / RRIV.
- The particular convention (MOU) of technical assistance of CIRAD signed between MARD and CIRAD including 2 permanents CIRAD specialists and short term scientific missions,
- In accordance with this agreement, the quotation from CIRAD is based on special prices linked to partnerships including compensatory indemnities cheaper than the usual honorary,

4. Location

RRIV Pleiku research centre and Chu Prong station.
ADP areas in highland and coastal provinces of Dak Lac, Gia Lai, Kon Tum, T.T. Hue, Quang Binh and Quang Tri, in cooperation with the different PPMUs.

5. Timing

The mission of Mr Clément-Demange will last for approximately 12-15 days including fields visits in the highland and coastal provinces, discussions with RRIV staff, CIRAD experts and the PCU smallholders specialist and a conference on rubber breeding. The mission should be planned next November according to the availability of Mr. Clément-Demange (CIRAD-CP) and the necessity to establish new clonal recommendations based on the latest RRIV results. Some logistic support will be requested from the PPMUs of the respective provinces in order to facilitate field access.

This proposal could modified in accordance to different contingencies and flights timetable (which have to be confirmed for the month of November).

6. Participants

Mr. Clément-Demange will be accompanied along the trip by two or three RRIV staff (including Mrs T.T.T. Hoa and Mr Lê Mau Tuy), the two CIRAD experts (F. Enjalric all along the mission and S. Boulakia, mainly in coastal provinces) located in Vietnam for the ADP project.

7. Expected results

As Mr. Clément-Demange has monitored the trials network for many years, he will be able to access the situation, particularly on breeding, and give recommendations and advice for the following up actions.

The results of the mission should provide an "up to date" clonal recommendations and a trials programme, adapted to the different agro-ecological environmental conditions of highland and coastal provinces.

The analysis has to point out the relevant results and must include proposals for new experimentation, including adaptation to sub-optimal conditions.

A final report in **English** (4 copies: 2 PCU, 2 RRIV) will be produced.

Vietnam

Agricultural Diversification Project (ADP)
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December 2-18, 2001

André Clément-Demange

Introduction

The consultant, belonging to Cirad, is visiting Vietnam for the fifth time. He is working in rubber since 16 years. He has visited clonal trials in many countries (Brasil, Cameroon, Gabon, Hainan (China), Yunnan (China), Thailand, Cambodia, Indonesia, Malaysia, but his main knowledge is issued from Côte d'Ivoire where he has been working as a rubber breeder for ten years.

The main purpose of this mission is to to assess the behaviour of clones taking into consideration the specific context of Vietnam ecological conditions.

This expertise is made of field observations, interpretation of cumulated data issued from the experimentation, and also of addition of knowledge, experience and personal convictions from the « expert » and from local researchers and agronomists. It is hoped that this work will be a positive contribution to the outputs of the Research Component of ADP project.

Schedule of the mission

South-East

3/12 Arrival 09 :30, departure for Lai Khê (Song Be province, Binh Duong/Ben Cat, 60 km far from Ho Chi Minh City), visit of trials CTLK89, CTLK90, STLK91, night in Lai Khê.

Central Highlands

4/12 Lai Khê > BMT > Pleiku by road n° 14, visit of trial CTKB89 in Krong Buk = north of Dak Lak province (CTEL97 not visited), night in Plei Ku (Gia Lai province, 750 m.a.s.l.)

5/12 Visit of trials CTMY92 and CTMY88 in Mang Yang Geruco Company, visit of trials QTCP85 and CTCP98 in Chu Prong Geruco Company, night in Pleiku

6/12 Visit of trial STPQ87 in Plei Can (Military Company n° 732) > Kon Tum, visit of CTKT85 and XTKT93 (stop at Geruco Kon Tum Company), night in Pleiku

7/12 Visit of trial CTCS93 in Chu Se, visit of Chu Prong station with CTCP00, STCP99A and STCP99B, visit of agronomic trials devoted to « Management of soil fertility by cover crops and intercropping ». Night in Pleiku. (Trial CTDC86 and XTDC94 in Military Company n° 75 in Duc Co not visited).

Coastal Provinces

8/12 Pleiku > Danang >Vinh (Nghê An province) by air, night in Vinh.

9/12 Visit of trials XTPQ97A, XTPQ97B and STPQ94 in the Phu Quy Fruit Research Centre near Vinh + visit of smallholders' plots, night in Vinh.

10/12 Vinh > Ha Tinh, discussion about the agriculture of the province at the provincial agricultural services, visit of trials CTHT98, XTHT98, STHT98, night in Dong Hoi.

11/12 Visit of trials in Quang Binh, night in Dong Ha.

12/12 Visit of trials in Quang Tri, night in Hué.

13/12 Visit of trials in T.T. Hué (Lam Dong district with trial CTTTH97, Huong Tra district (planting and inter-row management experimentation), night in Hué.

14/12 **Conference :**

« Clonal experimentation and recommendations. Results from other countries, specificities of Vietnam planting areas and choice of clones for smallholders in Central Highlands and Coastal Provinces of Vietnam »

- **Introduction by Mrs Trân Thi Thuy Hoa**
- **Presentation of the clonal experimental network in Vietnam by Mrs Trân Thi Thuy Hoa (RRIV Deputy Director)**
- **Presentation of results for Coastal Provinces by Mr Lê Mâu Tuy (RRIV Head of the breeding group)**
- **Presentation of results for Central Highlands by Mr Pham Hai Duong (RRIV researcher in charge of clonal experimentation in Central Highlands)**
- **Presentation of results for Côte d'Ivoire, Malaysia and Cambodia, submission of a draft proposal of clonal recommendations for ADP project, by A. Clément-Demange.**
- **Discussion.**

(at the house of the provincial agricultural services, around 25 persons from agricultural services and PPMUs, with Geruco coordinator for ADP project and ADP rubber specialist).

15/12 Hué > Ho Chi Minh city by air, second visit to Lai Khê with trials CTLK92, CTLK93, CTLK94, STLK93 and block plantings, night in HCMC.

16/12 Report preparation.

17/12 **Meeting in RRIV : a./Debriefing of the mission, b./Meeting with the Breeding Group.** Departure 20:10.

18/12 Arrival in Montpellier-France at 10 :00.

Contacts with partners and people

Frank Enjalric, Stephane Boulakia (Cirad)

Mr Mai Van Son (RRIV, director)
Mr Lai Van Lam (RRIV)
Mr Do Kim Thanh (RRIV)
Mrs Ngo Thi Hong Van (RRIV)

The RRIV Breeding group

Ms Trân Thi Thuy Hoa (RRIV, deputy director)
Mr Lê Mâu Tuy (RRIV, Head of breeding group)
Mr Vu Van Truong (RRIV, breeding groupe, Large Scale Clonal Trials South-East)
Mr Pham Hai Duong (RRIV, breeding groupe, Large Scale Clonal Trials South-East)
Mr Hai Truong Tan
Mrs Anh Lê Hoang Ngoc
Mr Tran Minh
Mr Tran Nam Viet
Mr Vi Van Toan
Mr Lê Gia Trung Phuc

Vinh

Mr Lê Dinh Son (ADP/PCU)
Mr Nguyên Quôc Hiêu (Director of Phu Quy Fruit Research Centre).

Hué
Mr Henk Zwinderman (ADP/PCU, rubber specialist)
Mr Murray Macclean (ADP/PCU, livestock specialist)
Mr Vo Van An (Geruco, coordinator for ADP project)

General context of rubber cropping in Vietnam

Since the introduction of rubber to Vietnam in 1897 (Dr Yersin), Vietnam has developped a strong tradition in rubber cropping, mainly on large estates of the South (Tay Ninh, Song Be, Dong Nai). From 77.000 ha in 1976, the area under rubber increased fastly and steadily. Today, Vietnam is producing 291.000 tons (6th world producer) and exporting 90 % of that amount. After Thailand and Indonesia, Vietnam belongs to a second group of 4 major producing countries with India, Malaysia and China. China is to be considered as a neighbour and a major importer. In recent years, Vietnam has been the country with the highest yearly increase of production. Consequently, Vietnam is in a position where it can play a major role in the management of the world rubber commodity channel as well as in the rubber wood industry, as a producer-exporter for now and also as a producer-user-exporter in the future.

The objective of Vietnam is to earn foreign currencies by exports and to provide rural employment, incomes and wages. To achieve these goals, the rubber commodity channel producing natural rubber and rubber wood is a good opportunity provided that the ecological conditions of lands under rubber as well as the labour productivity can achieve a good profitability of the plots and of the rubber-based farming systems.

The economic importance of rubber wood is increasing steadily and must be taken into account for assessing rubber profitability. New strategies may be developped based on wood added value. Apart from the direct economical objective, rubber can be seen as a diversification opportunity, especially for lands without irrigation possibilities. It can contribute to reafforestation, to run-off limitation and to the agricultural use of rather poor soils. Moreover, rubber cropping and natural rubber (renewable resource) can be claimed as « friendly to the global environment », due to their contribution to sparing fossile carbon and sequestrating carbon from the atmosphere, when compared with synthetic rubber.

The area under rubber is now of 412.000 ha with 232.000 ha (56 %) under tapping. The public sector represents 70 % of the area with 70 % of trees being tapped. In the more recent private sector, only 26 % of the area is being tapped.

The current distribution of rubber area is 68 % in the South, 24 % in Central Highlands, still non significant in Central Coastal Provinces and 8 % in Northern Coastal Provinces.

The current distribution of rubber production is 79 % in the South, 19 % in Central Highlands, still non significant in Central Coastal Provinces and 2 % in Northern Coastal Provinces.

Diversity of ecological contexts for rubber cropping

At the beginning of 20 th century, rubber was developped by French companies in the most favorable climatic area covering the provinces of Dong Nai, Binh Duong, Tây Ninh and Binh Phuoc, mostly made of red soils and grey soils (South). It was also developped in the neighouring province of Kâmpông Cham (with red soils) in Cambodia. This area is affected by a dry season of reasonnable duration with a limited water deficit, so allowing to open clone GT1 at an age of 6 years old.

So as to assist the extension of the planted area, RRIV, in cooperation with Cirad, has been experimenting rubber in less favorable zones such as Central Highlands (part of Lam Dong, Dac Lak, Gia Lai, Kontum) and in Coastal Provinces (from Center to North : Khanh Hoa, Phu Yen, Binh Dinh, Quang Ngai, Quang Nam, Thua Thien Hué, Quang Tri, Quang Binh, Ha Tinh, Nghê An and even at northern latitudes.

Considering ecological conditions, Central Highlands of Vietnam (around 100.000 ha in rubber now) appear as rather similar to Northeast of Thailand (around 60.000 ha in rubber now) : in this area, profitability is affected by a long immature period (GT1 can be opened between 7 and 9 years old) but the tapped stand can be maintained at a high level with high yield for a very long time due to the absence of wind damage.

In Coastal Provinces, wind risk has to be taken into account as a major factor for adapting rubber to this area. From South to North, depending on the length of the dry and cold season related with the latitude, the clone GT1 can be opened between 6 and 9 years old.

Elements to take into consideration for the evaluation of clones and for recommendations

This review of clones and recommendations is part of ADP Research Component and must fit with :

- the needs of smallholders (security and early income)
- the ecological constraints of provinces targetted by the project (compliance of growth with cold and dry seasons, wind risk, diseases such as Oïdium, Phytophtora, Corticium)
- the constraints of the implementation of the project (plant material production and distribution).

So as to limit risks, a diversification has to be proposed, but constraints of implementation of this diversification will also have to be taken into account :

- the difficulty of management of the multiplication and distribution of many clones at the same time increases with the number of clones
- smallholders have to be confident that they receive the « best » clones.

The economic importance of rubber wood is increasing steadily and must be taken into account for assessing rubber profitability. New strategies may be developped based on wood added value. Indeed, this fact raises the idea of shortening the economic lifespan of plots so as to take benefit from wood value as soon as possible. This emphasizes the demand for fast growth and fast yielding clones so as to be able to adapt to periods of low rubber prices in the future by felling the trees, selling the wood and replanting rubber or converting the plot to more profitable crops (so gaining more flexibility).

From a theoretical point of view, it would be very useful to model and optimize the income from both latex and wood over the whole of the economic lifespan of the plots. However, this has not been done yet. Consequently, we suggest that clonal recommendations for rubber in Vietnam can be based on the following main elements :

- 1. to ensure security at the level of agronomic performances
- 2. to promote clones able to be latex-timber clones (long and straight dominant stem), with a fast growth and a fast-increasing yield (so limiting the effect of the immature period)
- 3. if possible and necessary, to diversify the recommendations with latex producing clones which grow slower but with a higher latex yield potential.

For practical reasons related with the implementation of ADP project, the clonal diversification for one period of time will have to be limited. As a matter of fact, it is very uneasy to multiply and provide the farmers with many different clones. Moreover, smallholders want « the best clone » and can hardly understand that they don't have the same as the one of their neighbour. The best scheme would be that one farmer receives one clone for a first year of planting and a second clone for the second year. So as to give some possibilities of adaptation to the project, due to unforeseen constraints, we aim at proposing 3 to 4 clones for each ecological area (Binh Thuan, favorable areas of Highlands, less favorable areas of Highlands, Coastal provinces).

In Vietnam, root diseases are not a problem (and no resistant clonal rootstock does exist up to now).

Main diseases are Oïdium (PB235 susceptible), Phytophtora (leaves and panel, PB310 susceptible), Corticium and Colletotrichum.

The possible development of Corynespora has to be kept in mind (observed in 1999 on clones RRIC103, RRIC104, LH88/372, and also at a low level on PB235, RRIM600, VM515 and RRIC110).

The threat of introduction of Microcyclus (South American Leaf Blight) from Latin America must also not be forgotten, especially at the level of the travels of people from Latin America to Vietnam and of the introduction of living material issued from Latin America. However, this concern has no incidence on the choice of clones as all high yielding clones, issued from Wickham population, are very susceptible to most of Microcyclus strains.

Wind damage is affecting the South area at a rather limited level. This concern is of utmost importance in the Coastal Provinces which are frequently affected by typhoons. As this factor may suddenly destroy 50 % or sometimes more of the plot stand, wind susceptible clones (such as RRIC110 but also PB235, PB260) must be rigorously discarded from the whole of wind prone areas.

Tapping systems have to be adapted to the main economic objectives : production of land and/or productivity of labour. Reducing the tapping frequency will improve labour productivity with a yield reduction limited by the use of appropriate stimulation. Clones and tapping systems have to be jointly adapted to each other. Theoretically, the choice of clones would have to be influenced by the tapping system to be used. But this factor is an added constraint with no clear view of what will be the future tapping systems used. We choose not to take this aspect into account, just keeping in mind that each clone has its own metabolic type with a varying adaptation to the possible tapping systems, and with the need to ajust the tapping systems to the clones.

Clones subject to evaluation in the course of this mission

- All the clones from the following list have been encountered within trials visited during the mission :

GT1,

RRIV1 = LH82/122, **RRIV2** = LH82/156, **RRIV3** = LH82/158 (= BK8), **RRIV4** = LH82/182 (= BK15), **RRIV5** = LH82/198 (RRIV is a temporary code ; the choice of an official denomination for best clones created by RRIV in Vietnam is still under discussion).

LH 82/1, **82/8**, **82/9**, **82/36**, 82/42, **82/75**, **82/92**, **82/104**, **82/130**, **82/145**, **82/157**, **82/159**, **82/162**, **82/171**, 82/194, **82/213**, **83/29**, **83/32**, 83/36, 83/51, **83/75**, 83/85, **83/87**, 83/92, **83/93**, 83/99, 83/117, 83/140, 83/144, 83/150, 83/152, 83/215, 83/235, 83/237, 83/242, 83/255, 83/283, **83/289**, 83/290, 83/411, 83/416, 83/429, 83/439, 83/450, 83/451, 83/563, 83/564, 83/596, 83/605, 83/607, 83/621, 83/721, 83/724, 83/732, 83/735, 86/15, 86/96, 86/112, 86/146, 87/23, 87/25, 87/100, 87/132, 87/136, 87/158, 87/192, 87/227, 87/235, 88/61, 88/102, 88/202, 88/207, **88/241**, **88/251**, 88/341, 88/345, 88/372, 89/177, 90/96, 90/109, 90/117, 90/140, 90/271, 90/326, 90/337, 93/142, 93/349, 94/13, 94/158, 94/261, 94/267, 94/286, 94/359, 94/481, 94/501, 94/592, 94/630, 95/544.

VE2.
LK7, 101, 102, 104, 201, 202, 203, 204, 205, 206, 301, 302, 304, 306.

PBIG 7/6, **9/31**, 12/81, 14/51, 15/12, 16/18, 17/1, 17/9, 19/25, **21/1**, 21/15, 23/27, 23/37, 24/44, 29/74, 31/25, 35/7.

IRCA 18, 19, 22, 27, **41**, 101, **109**, **111**, 120, 130, 202, **209**, 229, **230**, 317, 321, 324, 331, 339, 408, 515, 519, 523, 564, 570, 573, 617, 621, 726, 737, 739.

PB 28/59, 86, **217**, **235**, **254**, **255**, **260**, **280**, **310**, **311** (VM519), **312**, **314**, **324**, **330**.
PR 107, 255, 261.
RRIC 100, 101, 102, **103**, 104, **105, 110**, 112, 114, 115, **117, 121, 132**.
RRIM 600, 712, 725.
VM515.
IAN873.
TR3702.
Scatc 88/13, Haiken1, Reyan93/114.
BPM24.

AC/I/24, AC/I/25, AC21/100, AC37/425, AC54/195, MT48/47, MT57/54, RO/I/25, RO38, RO55, RO3/94, FDR1305, GU176, IAN710, IAN2878, IAN2903, IAN6721, FX3864.

This list is made of 225 clones including 135 clones created (RRIV, LH, LK, IV, VE) or selected (PBIG) in Vietnam, and other clones from different countries abroad. Apart from 19 amazonian clones, all the others are Wickham clones. It is not the goal here to study amazonian clones, as quite all of them are proved to be non competitive for yield out of Microcylus prone areas.

Among these clones, 66 of them have been evaluated in at least one large scale trial such as CT, XT or QT design (these clones are in bold in the list).

GT1, used as control, is part of 22 large scale trials.

- Among all these clones, the following short list of 36 clones was identified as a basis for discussion, after the visit of trials and examination of data, for proposing new clonal recommendations :

GT1, PB235, RRIM600 (current recommendations for first phase of ADP project)

Clones created in Vietnam :
RRIV1, RRIV2, RRIV3, RRIV4, RRIV5
LH 82/9, 82/75, 82/92, 83/85, 83/150, 83/152, 83/283, 83/289, 83/290, 83/732, 88/61, 88/241

IRCA130, IRCA230, IRCA331
PB217, PB255, PB260, PB310, PB312, PB314, PB324, PB330
RRIC100, RRIC110, RRIC121
RRIM712
VM515

- After having discarded VM515 (see below), the final discussions were around the following 12 clones for possible recommendations:

GT1, PB235, RRIM600, PB260, RRIC110, RRIC121, RRIV2, RRIV4, RRIC100, RRIM712, PB255, LH82/92,

and 19 promising clones for more experimentation : PB312, PB314, PB330, IAN873, IRCA130, IRCA230, IRCA331, RRIV1, RRIV3, RRIV5, LH82/9, LH82/75, LH83/85, LH83/152, LH83/283, LH83/290, LH83/732, LH88/61, LH88/241.

Consequently, the 5 following clones have been discarded : LH83/150, LH83/289, PB217, PB310, PB324.

Trials taken into consideration in the course of this mission

South (Lai Khê):

CTLK89: GT1, RRIM712, RRIM725, RRIC132, PB217, PB260, PB330, PBIG9/31, PBIG21/1, LH82/9, LH82/92, LH83/93.

CTLK90: GT1, PB235, PB280, VM515, IAN873, LH82/130, RRIV2, RRIV3, LH82/159, LH82/162, LH82/171, RRIV4, RRIV5, LH82/213.

STLK91: GT1, PB217, PB235, RRIM600, VM515.
LH 83/36, 83/51, 83/117, 83/235, 83/237, 83/242, 83/255, 83/290, 83/411, 83/416, 83/439, 83/451, 83/596, 83/607, 83/621, 83/735, 86/15, 86/96, 86/112, 86/146, 87/23, 87/25, 87/100, 87/132, 87/136, 87/158, 87/192,
IRCA 18, 19, 22, 41, 101, 109, 111, 120, 130, 202, 209, 229, 230, 317, 321, 324, 331, 339.

CTLK92: GT1, RRIV3, RRIV4, PB235, PB260, VM515.

CTLK93: GT1, PB235, PB311, PB314, RRIC101, TR3702, IRCA18, IRCA109, IRCA111, IRCA230, LH82/8, LH82/104, RRIV1, LH82/157, LH83/29, LH83/32, LH83/87, LH83/289.

STLK93: full list of clones not taken, but including
IRCA19, 27, 408, 515, 519, 523, 564, 570, 573, 617, 621, 726, 737, 739,
LH 87/227, 87/235, 88/61, 88/102, 88/202, 88/341, 88/345, 88/372.

CTLK94: GT1, PB235, PB260, BPM24, IRCA41, IRCA209, LH82/36, LH82/145, LH83/75, LH88/241, LH88/251.

Block plantings or toask-size plantings of different clones: PB235, PB255, PB330, RRIV2, RRIV4, RRIV5, LH82/8, LH82/157, LH83/87 (1995), RRIV3 (1996),

Central Highlands:

Krong Buk (altitude)

CTKB89: GT1, Haiken1, Scatc88/13, LH82/9, LH82/75, LH82/92, RRIV1, PB235, PB254, PB310, PB324, PR107, RRIC110, RRIC121, RRIM600, RRIM712, RRIM725, VM515.

Eah Leo

CTEL97: GT1, IRCA230, IRCA18, PB235, PB255, PB260, RRIC110, RRIM600, RRIV2, RRIV3, RRIV4, VM515.

Mang Yang (altitude)

CTMY88: GT1, LH 82/75, PB235, PB255, PB260, PB310, VM515.

CTMY92: GT1, IRCA18, IRCA111, RRIV4, RRIV5, PB217, PB235, PB260, RRIC100, RRIC110, RRIM600, VM515.

Chu Prong

QTCP85: GT1, PR255, PR261, RRIM600, PB235, PB310,VM515.

CTCP98: GT1, RRIV2, RRIV3, RRIV4, PB235, PB260, RRIM600, RRIC110, RRIC121, VM515.

STCP99A: GT1, PB235, PB255, PB260, RRIM600, IC737, LH RRIV4, 87/235, 89/177, 90/337, 90/140, 93/142, 94/13, 94/158, 94/267, 94/359, 94/630, 95/544, LK 7, 102, 201, 202, 203, 204, 205, 306, VE2, VM515.

STCP99B: GT1, PB235, PB260, LH RRIV4, 88/241, 90/109, 90/117, 90/326, 93/349, 94/261, 94/286, 94/481, 94/501, 94/592, LK 101, 104, 206, 301, 302, 304.

CTCP00: trial not old enough for providing useful information.

Duc Co (not visited)

CTDC86: GT1, PB235, PB255, PB310, PB324, PR255, RRIC105, RRIC110, RRIC117, RRIC121, RRIM600, VM515.

XTDC94: RRIC110, IRCA18, LH82/157, RRIV3, VM515.

Plei Can

STPC87A: GT1, AC54/195, MT48/47, RO/I/25, FDR1305, GU176, IAN710, IAN2878, IAN6721, LH 82/1, 82/9, 82/42, RRIV2, RRIV3, 82/194, RRIV5, 83/99, 83/140, 83/150, 83/152, 83/289, 83/450, 83/563, 83/564, 83/605, 83/721, 83/732, PBIG 7/6, 9/31, 12/81, 14/51, 15/12, 19/25, 21/1, 21/15, 24/44, 29/74, 31/25, 35/7, PB235, PB310, PB324, RRIC102, RRIC103, RRIC104, RRIC112, RRIC114, RRIC115, RRIC121, RRIM600, RRIM725, VM515.

STPC87B: AC/I/24, AC/I/25, AC21/100, AC37/425, MT57/54, RO55, RO3/94, IAN873, IAN2903, LH 82/130, 82/159, 83/144, 83/215, 83/429, 83/724, PBIG 16/18, 17/1, 17/9, 23/27, 23/37, PB260, PB280, PB311, PB312, RRIC101, RRIC112, RRIC115, RRIC117, RRIM712, Scatc88/13, Reyan93/114.

Chu Se

CTCS93: GT1, RRIM600, RRIM712, PB217, PB260, PB330, IRCA18, IRCA230, RRIV4, RRIV5, RRIC100, RRIC110.

Kon Tum

CTKT85: GT1, PB235, PB255, PB310, PB324, PR255, PR261, RRIC103, RRIC105, RRIC110, RRIM600, VM515.

XTKT94: RRIV3, RRIV4, PB260, IRCA111.

Coastal Provinces

Nghê An, Phu Quy Fruit Research Centre

STPQ94: GT1, LH 82/8, 82/92, RRIV1, 82/157, RRIV3, RRIV4, IAN873, Haiken1, Reyan93/114, Scatc88/13, IRCA18, IRCA230, RRIC100, RRIC101, RRIC102, RRIC110, RRIM712, RRIM600, PB86, PB217, PB235, PB254, PB255, PB260, PB280, PB330, PR107, PR255, PR261, VM515.

XTPQ97A: RRIV2, RRIV3, RRIM712, IRCA230, PB260.

XTPQ97B: RRIV3, RRIM712, IRCA230.

Ha Tinh Province

STHT98 : GT1, BPM24, PB28/59, PB86, PB217, PB235, PB255, PB260, PB280, PB311, PB312, PB324, PB330, IRCA18, IRCA230, IAN873, FX3864, RRIM600, RRIM712, RRIC100, RRIC102, RRIC121, RRIC132, LH 82/8, RRIV2, RRIV3, RRIV4, 83/29, 83/32, 83/87, 83/92, 87/23, 90/96, 90/271, PR107, PR255, PR261, VM515.

XTHT98 : GT1, PB255, PB260, PR261, PR255, RRIM600, RRIM712, RRIV3.

CTHT98 : GT1, RRIC100, RRIC121, LH82/8, RRIV2, RRIV4, LH83/87, PB235, PB255, PB280, PB312, RRIM600, RRIM712, IRCA230.

Quang Binh Province

Viet Trung Company

QTVT90 : GT1, PB235, PB255, VM515.

Clonal field established by Viet trung Company in 1994 : Haiken1, Scatc88/13, LH82/92, PR255, RRIC110, VM515.

XTVT97 : GT1, PB255, PB260, RRIM712, RRIV2, IRCA230.

XTQB97 : GT1, PB255, PB260, RRIM712, RRIV2, IRCA230.

Quang Tri Province

CTQT88 : GT1, PB235, PB310, RRIM600, LH82/9, LH82/92.

Thua Thien Hué Province, Nam Dong district

CTTTH97 : GT1, PB235, PB255, PB260, RRIV2, RRIV3.

Location of each clone within the large scale experimentation

GT1	22 trials
PB235	16 trials CTLK90, CTLK92, CTLK93, CTLK94, CTKB89, CTEL97, CTMY88, CTMY92, CTCP98, QTCP85, CTDC86, CTKT85, CTHT98, QTVT90, CTQT88, CTTTH97
PB260	14 trials CTLK89, CTLK92, CTLK94, CTEL97, CTMY88, CTMY92, CTCP98, CTCS93, XTKT94, XTPQ97A, XTHT98, XTVT97, XTQB97, CTTTH97
VM515	14 trials CTLK90, CTLK92, CTKB89, CTEL97, CTMY88, CTMY92, CTCP98, QTCP85, CTDC86, CTKT85, XTDC94, CTCS93, CTHT98, QTVT90
RRIM600	12 trials CTKB89, CTEL97, CTMY92, CTCP98, QTCP85, CTDC86, CTKT85, CTCS93, CTCS93, XTHT98, CTHT98, CTQT88
PB255	11 trials CTEL97, CTMY88, CTDC86, CTKT85, CTCS93, XTHT98, CTHT98, XTVT97, XTQB97, CTTTH97, QTVT90
RRIV3	9 trials CTLK90, CTLK92, CTEL97, CTCP98, XTKT94, XTPQ97A, XTPQ97B, XTHT98, CTTTH97
RRIM712	9 trials CTLK89, CTKB89, CTCS93, XTPQ97A, XTPQ97B, XTHT98, CTHT98, XTVT97, XTQB97
RRIC110	9 trials CTKB89, CTEL97, CTMY92, CTCP98, CTDC86, CTKT85, XTDC94, CTCS93, CTCS93
RRIV2	8 trials CTLK90, CTEL97, CTCP98, XTPQ97A, CTHT98, XTVT97, XTQB97, CTTTH97
RRIV4	8 trials CTLK90, CTLK92, CTEL97, CTMY92, CTCP98, CTCS93, XTKT94, CTHT98
IRCA230	8 trials CTLK93, CTEL97, CTCS93, XTPQ97A, XTPQ97B, CTHT98, XTVT97, XTQB97

PB310	6 trials :CTKB89, CTMY88, QTCP85, CTDC86, CTCS93, CTQT88
IRCA18	5 trials : CTLK93, CTEL97, CTMY92, XTDC94, CTCS93
PR255	5 trials : QTCP85, CTDC86, CTKT85, CTCS93, XTHT98
RRIC121	CTKB89, CTCP98, CTDC86, CTHT98
PB324	CTKB89, CTDC86, CTKT85, CTCS93
PR261	QTCP85, CTKT85, CTCS93, XTHT98
RRIV5	CTLK90, CTMY92, CTCS93
LH82/9	CTLK89, CTKB89, CTQT88
LH82/92	CTLK89, CTKB89, CTQT88
IRCA111	CTLK93, CTMY92, XTKT94
PB217	CTLK89, CTMY92, CTCS93
RRIC100	CTMY92, CTCS93, CTHT98
RRIC105	CTDC86, CTKT85, CTCS93
RRIV1	CTKB89, CTLK93
LH82/8	CTLK93, CTHT98
LH82/75	CTKB89, CTMY88
LH82/157	CTLK93, XTDC94
LH83/87	CTLK93, CTHT98
PB280	CTLK90, CTHT98
PB330	CTLK89, CTCS93
RRIM725	CTLK89, CTKB89
RRIC103	CTKT85, CTCS93
LH82/36	CTLK94
LH82/104	CTLK93
LH82/130	CTLK90
LH82/145	CTLK94
LH82/159	CTLK90
LH82/162	CTLK90
LH82/171	CTLK90
LH82/213	CTLK90
LH83/29	CTLK93
LH83/32	CTLK93
LH83/75	CTLK94
LH83/93	CTLK89
LH83/289	CTLK93
LH88/241	CTLK94
LH88/251	CTLK94
PBIG9/31	CTLK89
PBIG21/1	CTLK89
IRCA41	CTLK94
IRCA109	CTLK93
IRCA209	CTLK94
PB254	CTKB89

PB311	CTLK93
PB312	CTHT98
PB314	CTLK93
PR107	CTKB89
RRIC101	CTLK93
RRIC117	CTDC86
RRIC132	CTLK89
IAN873	CTLK90
TR3702	CTLK93
Scatc88/13	CTKB89
Haiken1	CTKB89
BPM24	CTLK94

As a matter of fact, the intensity of experimentation of the clones is already the result of successive choices made by the breeders for gradually promoting the best clones.

We observe that the 12 clones identified as more interesting have been evaluated over a number of trials varying between 3 and 16 (22 for GT1). The number of trials for clones PB235, PB260, RRIM600, PB255, RRIC110, RRIM712, RRIV2 and RRIV4 varies between 16 and 8. RRIC121 is tested only in 4 trials. RRIC100 and LH82/92 are tested only in 3 trials.

VM515 is tested on 14 trials.

Considering the 19 promising clones identified for more experimentation, 2 of them (RRIV3 and IRCA230) are on 9 and 8 trials respectively, 2 on 3 trials (RRIV5, LH82/9), 3 (PB330, RRIV1, LH82/75) on 2 trials, 4 (PB312, PB314, IAN873, LH88/241) only on 1 trial ; 8 of these clones (IRCA130, IRCA331, LH83/85, LH83/152, LH83/283, LH83/290, LH83/732, LH88/61) have not been set into large scale experimentation yet (tested only at small scale).

Experimental results and recommendations issued from the experimentation in Vietnam

The expert has been provided with many documents issued by the RRIV Breeding Group, including results and data from the clonal experimentation in Vietnam as well as previous recommendations (cf references hereafter). All these documents were used during the mission for comparing the data with the aspect of the clones in the trials.

GT1 and PB235 are mostly used as controls.

ADP project is supposed to spread over Binh Thuan province (with favorable conditions for rubber equivalent to Song Be and Dong Nai in the South), Central Highlands and Coastal provinces.

In Central Highlands, 2 types of sites are considered :
- Area A, more favorable, below 600 m.a.s.l. : sites of Kon Tum, Duc Co, Chu Prong
- Area B, less favorable, above 600 m.a.s.l. : sites of Mang Yang, Chu Se, Krong Buk, Plei Can

These two ecological types can be differentiated not only by altitude but also by the frequency of wind (affecting water deficit), by soil fertility or by Oïdium incidence. Consequently, we have to consider rather good conditions in area A and harder conditions in area B. Mapping these 2 ecological types in Highlands would be useful. In Highlands, the effect of steady winds cannot be related with any occurrence of wind damage. Wind risk seems to be non significant in Highlands. Consequently, a high level of tappable trees can be maintained for a very long time in situations where TPD is limited.

The Coastal provinces can be differentiated from South to North by latitude associated with an increasing dry and cold season, and with a longer immature period in the North. Wind risk can be very important just near to the seaside, but probably lower in places more distant from the coast.

In the following descriptions of clones, a score from 1 (poor) to 5 (very performant) is used. GT1 is commonly scored 2 for growth as well as for yield. The scores are written within brackets after the names of the trials.

The case of VM515

As it happened to other clones in other countries, VM515 was introduced under another name to Vietnam and proved to be non conform and from unknown genetic origin. However, the performances of this clones were attractive and justified intensive testing.

The crown of this clone is made of many secondary branches of equivalent sizes (a little like RRIM600).

Growth score : CTKT85 (3), QTCP85 (4), CTDC86 (4), STPC87 (3), CTMY88 (3), CTKB89 (2), QTVT90 (3), STLK91 (3), CTMY92 (3), STPQ94 (3), XTDC94 (2), CTEL97 (2), CTCP98 (2), STHT98 (2).

So, this clone has a rather good vigour. More interestingly, it has a fast-increasing and high yield.

Yield score : QTCP85 (4), CTKT85 (4), CTDC86 (4), CTMY88 (5), CTKB89 (3), STLK91 (5), CTMY92 (4), STPQ94 (3).

Second highest yield in STLK91.

Susceptibility to Oïdium seems medium.

Because of these yield performances, the temptation to recommend it is high (it has been suggested for a first stage of use in the research component of the feasibility study in 1997 ; it has also been introduced in RRIV recommendations 1999-2001 for estates). However, this clone can also be considered as one of the most susceptible clones to TPD, bark necrosis and brown bast (CTDC86, CTKT85, CTKB89, QTCP85, XTDC86). This behaviour has also been observed in the large scale clonal trial set in Chup (Cambodia) in 1986. Because of this susceptibility, a high yield could not be maintained for a reasonnable period, even in the case of shorter economic lifespans of the plots.

For this reason, the RRIV Breeding Group decided not to maintain this clone in possible recommendations to the ADP project. The expert fully agrees with this decision.

Description of the behaviour of the more interesting 36 clones, issued from the experimentation in Vietnam

First list of 12 clones

GT1 (primary clone).
- One of the most planted clones in the world, especially on smallholdings.
- Used as control in most of the trials in Vietnam and Côte d'Ivoire.
- Growth before opening and yield can be considered as a necessary minimum (level 2).
- Could be better managed under intensive stimulation with good response (not much susceptible to TPD, adaptable to low tapping frequencies).
- For smallholders : rather slow growth and very slow covering.
- Risk from diseases: low (Colletotrichum in other countries).
- Risk of wind damage : low .
- Seems to have a good behaviour in cold conditions and at high altitude (very good behaviour at 700 m in Krong Buk)
- Wood value : 3.
- Level of knowledge in Vietnam: 5
- Level of knowledge by Cirad in other countries : 5
- Recommendations in ADP project : class 1, can be recommended in any area (rather limited performance but low level of risk).
- High sucess rate in grafting.

There is no restriction to the use of this clone except for the level of performances. As the growth and yield performances may now appear rather low, this clone will be used mainly for security reasons in cold prone areas of Highlands and in wind-risky areas of Coastal Provinces.

PB235 (PB5/51 x PBS/78)
- Very fast growth. However the growth seems lower in trials at higher altitude (maybe related with Oïdium in these sites).
- Very high yield with fast increase of yield.
- TPD : high susceptibility (to use with moderate stimulation only).
- Oïdium : high susceptibility.
- Wind damage : high susceptibility.
- Wood value : high because of a long and vigourous straight stem.
- Growth score : QTCP85 (5), CTKT85 (5), CTDC86 (5), CTMY88 (2), CTKB89 (2), QTVT90 (3), STLK91 (5), CTMY92 (2), STPQ94 (4), CTEL97 (4), CTCP98 (2), STHT98 (2), CTHT98 (3).
- Yield score : QTCP85 (5), CTKT85 (5), CTDC86 (4), CTMY88 (4), CTKB89 (2), STLK91 (4), CTMY92 (2), STPQ94 (3),

*PB235 can be considered as a dual purpose **latex-timber** clone and is the true type for adaptation to the reduction of immature period and shortened economic lifespan. But this clone is very susceptible to wind damage, Oïdium and TPD. It must be recommended only out of wind-prone areas. It will be performant in the South and in favorable areas of Highlands.*

RRIM600 (TJIR1 x PB86)

- One of the most planted clones in the world, especially on smallholdings.
- Growth : more often lower than GT1.
- Rather high yield.
- Adapted to intensive stimulation with good response (physiology : rather active with medium sucrose reserves, not much susceptible to TPD).
- Dense canopy (due to abundant branching) but not yet in the immature period.
- Oïdium : low susceptibility, which is a strong point in Vietnam.
- Corticium : supposed to be very susceptible.
- Risk of wind damage : rather low (moderate height) but possible branch snap
- Wood value : high quantity of biomass due to abundant branching at a low level but short main stem.
- Very susceptible to Corynespora in North Sumatra.
- Recommendations in ADP project : class 1, high level of knowledge and limited risk for smallholders.
- Visual aspect rather negative in CTCS93 due to poor vigour
- Growth score : QTCP85 (1), CTKT85 (1), CTDC86 (2), CTKB89 (1), STLK91 (1), CTMY92 (2), CTCS93 (1), STPQ94 (2), CTEL97 (2), STHT98 (1),
- Yield score : QTCP85 (3), CTKT85 (2), CTDC86 (4), CTKB89 (4), STLK91 (1), CTMY92 (4), STPQ94 (4),

RRIM600 has a growth rather lower than GT1 and a yield higher than GT1. It is tolerant to Oïdium and quite resistant to wind. It can be recommended for security in wind-risky areas such as Coastal Provinces as well as in areas hardly affected by Oïdium.

PB260 (PB5/51 x PB49)
- Fast growth.
- High yield with fast increase in yield.
- Not adapted to intensive stimulation (physiology : active but low sucrose reserves, very susceptible to TPD).
- For smallholders : fast growth and fast covering.
- Oïdium : rather resistant
- Risk of wind damage : high (not to be recommended for wind-prone areas).
- Wood value : high (long, vigorous and straight main stem).
- Very susceptible to Corynespora in North Sumatra.
- Very positive visual aspect in CTCS93, medium in XTKT93.
- Growth score : CTMY88 (3), CTMY92 (2), CTCS93 (3), XTKT93 (3), STPQ94 (1), CTEL97 (4), XTVT97 (5), XTPQ97 (3), STHT98 (2), XTHT98 (2),
- Yield score : STPQ94 (3), CTMY88 (5), CTMY92 (5).

PB260 cannot be recommended in wind-prone areas such as Coastal Provinces. Its vigour is not very high. However yield can be very high, possibly in rather elevated sites like Mang Yang. Moreover, this clone seems tolerant to Oïdium. Consequently, recommendation of this clone can be located more in Oïdium affected areas or at higher altitudes in Highlands. PB260 may become a good ***latex-timber*** *clone. As PB260 is genetically very close to PB235, it does not represent a good diversification as added to PB235, with the exception of less favorable areas of Central Highlands.*

RRIC110 (LCB1320 x RRIC7)
- Growth : better than GT1.
- Very high and fast increasing yield.

- Adapted to medium stimulation (physiology : rather active with medium-low sucrose reserves, not much susceptible to TPD).
- Oïdium : medium-low resistance
- Branching at medium height.
- Risk of wind damage : very high, clone to be strictly discarded in wind-prone areas (very severe damages observed in Malaysia, Indonesia and Côte d'Ivoire).
- Wood value : medium (branches at medium height)
- Susceptible to Corynespora in Sri-Lanka.
- Growth score : CTKT85 (4), CTDC86 (5), CTKB89 (5), CTMY92 (3), CTCS93 (2), XTDC94 (4), STPQ94 (3), CTEL97 (3).
- Yield score : CTKT85 (4), CTDC86 (5), CTKB89 (5), CTMY92 (4), STPQ94 (4).

The main problem of RRIC110 is its very high susceptibility to wind damage. Also susceptible to Corynespora. This clone has a good vigour, a high yield and a rather good ***latex-timber*** *value. With the absence of wind risk on Highlands, this clone could be performant and could be recommended in this area.*

RRIC121 (PB28/59 x IAN873)
- Oïdium : medium tolerance
- Crown with some heavy branches
- In Côte d'Ivoire and Cambodia, growth is high, especially during tapping.
- In Côte d'Ivoire, yield is not very high. In Cambodia, it seems to increase its yield.
- Very early defoliation.
- Attacked by Corynespora in Nigeria (1994-1995).
- Wind damage in one trial in Côte d'Ivoire in 1999.
- Growth score : CTDC86 (4), CTKB89 (2), CTHT98 (5)
- Yield score : CTDC86 (4), CTKB89 (4).

Results for this clone are still limited but RRIC121 could become interesting because of its fast growth (before and during tapping) and its yield-increasing trend. It might be fitted to Coastal Provinces. Experimentation of this clone needs to be specifically emphasized in wind prone areas, in controlled conditions as well as in multilocal farmers' plots, in a participative way.

RRIV2 (LH82/156) (RRIC110 x RRIC117)
- High vigour, high yield, long stem for timber
- Very attractive aspect
- Susceptible to Corticium in CTLK90.
- Growth score : CTEL97 (5), XTVT97 (1), XTPQ97 (4), STHT98 (5), CTHT98 (4),
- Yield score : STPC87 (4), CTLK90 (4).

The fast growth and high yield of this clone are good characteristics for adaptation to shortened economic lifespan with ***latex-timber*** *dual purpose. It can be used without any restriction in the South. We suggest to initiate its development in Coastal Provinces. We also suggest to compare 2 girth sizes for opening this clone: 50 cm (standard) and 55 cm (delayed opening, but not later than GT1 or RRIM600, with improved rigidity and better resistance to wind damage).*

RRIV4 (LH82/182 or BK15) (RRIC110 x PB235)
- Under stimulation : more information required.
- High vigour and high yield, but less performant in the less favorable area of CTMY92.
- Risk of wind damage : problems observed in the South of Vietnam (CTLK90).
- Wood value : 4 (long and straight trunk, vigourous clone).
- Growth score : CTMY92 (3), CTCS93 (3), XTKT93 (4), STPQ94 (4), CTEL97 (5), STHT98 (4), CTHT98 (5),
- Yield score : CTLK90 (5), CTMY92 (3), STPQ94 (5).
- Second highest yielder in STPQ94

The fast growth and high yield of RRIV4 are good characteristics for adaptation to shortened economic lifespan with ***latex-timber*** *dual purpose. Because of wind risk, this clone has to be developped in Highlands first. Long term knowledge and more experimentation are waited for the extension of recommendations.*

RRIC100 (RRIC52 x PB86)
- Growth : more often high.
- Oïdium : resistant.
- Risk of wind damage : rather low (moderate height).
- Yield in Côte d'Ivoire is not much higher than GT1. This clone is more interesting in areas affected by leaf diseases.
- Very good level of resistance to Corynespora in North Sumatra.
- This clone could be well adapted to smallholders because of a good growth and a good resistance to many leaf diseases.
- Growth score : CTMY92 (5), CTCS93 (1), STPQ94 (3), STHT98 (3), CTHT98 (3),
- Yield score : STPQ94 (3), CTMY92 (3).

Information on this clone in Vietnam is still limited. The best aspect is observed in CTMY92. This clone usually has a high level of tolerance to leaf diseases in the field (Colletotrichum, Corynespora, Oïdium). High yield is not waited from this clone. Growth is usually very good but it seems to vary in this experimentation. Low grafting sucess rate may be a problem for implementation in the framework of a smallholders' project. Experimentation of this clone needs to be emphasized, especially in smallholders' demonstration plots.

RRIM712 (RRIM605 x RRIM71)
- Growth : more often equivalent to GT1.
- Wood value : medium-low.
- This clone seems very much influenced by environment for growth and can show a very negative visual aspect.
- Not very performant in Côte d'Ivoire.
- Very susceptible to Corynespora in North Sumatra.
- Visual aspect rather negative in CTCS93 due to poor vigour, also in CTKB89 or in CTLK89.
- Growth score : CTKB89 (1), CTCS93 (1), STPQ94 (2), XTVT97 (3), XTPQ97 (3), STHT98 (2), XTHT98 (2), CTHT98 (3).
- Yield score : CTKB89 (4), STPQ94 (4).
- Fifth highest yielder in STPQ94

The yield information is still limited but yield seems to be high. However, growth is only equivalent to GT1. Specific advantages of RRIM712 are not clearly demonstrated (from the viewpoint of the expert but RRIV experience seems more positive with that clone).

PB255 (PB5/51 x PB32/36)
- The trunk is often not very straight (slightly twisted).
- Yield sometimes very high in Côte d'Ivoire.
- Grafting success may be low.
- Oïdium : good level of resistance
- Wood value : medium-high. The trunk is long and branching occurs at a rather high level.
- Growth score : CTKT85 (2), CTDC86 (2), CTMY88 (4), QTVT90 (5), STPQ94 (3), STHT98 (1), XTHT98 (1), CTHT98 (3).
- Yield score : CTKT85 (2), CTDC86 (3), CTMY88 (4), STPQ94 (3).

Growth of PB255 varies according to locations. Yield is more often better than GT1. The advantages of this clone don't appear clearly (from the viewpoint of the expert, but RRIV experience seems much more positive for that clone).

LH82/92 (RRIC110 x RRIC123)
- Oïdium : medium
- Visual aspect 4-5.
- Wood value, tall and straight trunk.
- Good response to stimulation.
- Growth score : CTKB89 (3), STPQ94 (5).
- Yield score : CTLK89 (3), CTKB89 (3), STPQ94 (3).

With growth and yield rather better than GT1, a nice aspect and a good ***latex-timber*** *value, this clone appears interesting. Experimentation would have to be extended for assessing LH82/92 as a dual purpose latex-timber clone.*

Second list of 19 clones

PB312 (RRIM600 x PB235)
- Tested only in 1 Large Scale Clonal Trial (LSCT), CTHT98 (fast growth).
- Yield compared with GT1 : g/t/t = 195 % in STPC87/2.
- In Côte d'Ivoire : latex-timber clone, fast growth, high yield, high susceptibility to wind damage, quite susceptible to TPD, active metabolisme (class 3)

*This clone could be considered as a **latex-timber** clone for future use in Central Highlands. More testing would be necessary with attention to susceptibility to diseases.*

PB314 (RRIM600 x PB235)
- Tested only in 1 Large Scale Clonal Trial (LSCT), CTLK93 (high yield but not very vigorous)
- Block planting in Geruco plantation in Dong Phu (opened)
- In Cote d'Ivoire : architecture of RRIM600 type (many branches at low level), fast growth and high yield, high susceptibility to wind damage, quite susceptible to TPD, active metabolism.

This clone could be considered for future use in Central Highlands. More testing would be necessary with attention to susceptibility to diseases.

PB330 (PB5/51 x PB32/36)
- Tested in CTLK89 (yield a little lower than PB260) and CTCS93 (best growth of the trial)
- Positive visual aspect in CTCS93
- Oïdium : susceptible
- Risk of wind damage : tall and straight tree with light secondary branches (damage observed in North Sumatra).
- Wood value : 5 (very long and straight main stem).
- Rather tolerant to Corynespora in North Sumatra.
- In Côte d'Ivoire : same architecture (long main stem), fast growth, rather high yield, active metabolism, good level of RSH (latex diagnosis), however rather susceptible to TPD

*This clone could be considered as a **latex-timber** clone for future use in Central Highlands. More testing would be necessary with attention to susceptibility to diseases.*

IAN873 (PB86 x FA1717)
- Tested only in 1 LSCT (CTLK90) with yield intermediate between GT1 and PB235
- The amazonian male parent probably tends to reinforce resistance to leaf diseases and fast growth but is limiting for yield.
- In Côte d'Ivoire : fast growth but limited yield.
- In Mato Grosso (Brasil area rather similar to Highlands), this clone is vigorous but yield is limited compared with GT1, PB235, RRIM600.

The expert does not think that this clone can actually have an interest in Vietnam due to low yield levels achieved in other countries.

IRCA130 (PB5/51 x IR22)
- In STLK90 : best yield of IRCA clones and third highest yield of the trial. No testing in LSCT in Vietnam
- In Côte d'Ivoire : architecture similar to PB330 (long main stem), good growth and high yield, very susceptible to wind damage.

*Experimentation could be developped for this clone with possible future use as **latex-timber** clone in Central Highlands only.*

IRCA230 (GT1 x PB5/51)
- Tested on 8 large scale trials in Vietnam
- Growth score : CTCS93 (2), STPQ94 (3), CTEL97 (5), XTVT97 (5), XTPQ97 (3), STHT98 (2), CTHT98 (4)
- Yield score : STLK91 (3), STPQ94 (3)
- In Côte d'Ivoire : architecture made of a long main stem, very fast growth and very high yield, active metabolism and high level of sucrose (latex diagnosis), no observation of wind damage in spite of the architecture not susceptible to TPD (class 1).
- Oïdium : susceptible
- Corynespora : very susceptible in North Sumatra
- Wood value : 5.

*IRCA230 can become very attractive as a **latex-timber** clone, but yield information is not yet available.*

IRCA331 (GT1 x RRIM600)
- Not yet tested in LSCT. Very nice visual aspect in STLK90.
- In Côte d'Ivoire : architecture of GT1 type but taller than GT1, dark green leaves, good growth and high yield, not susceptible to wind damage, class 1.

Experimentation could be developped for this clone with possible future use in any area including Coastal Provinces.

RRIV1 (LH82/122) (RRIC110 x RRIC117)
- Tested in only 2 large scale trials : CTKB89 and CTLK93
- Oïdium : medium
- Rather negative visual aspect in CTKB89
- Growth compared with GT1 : equivalent in CTKB89
- Yield compared with GT1 : 133 % for 5 years of tapping in CTKB89 (highest yield of the trial).
- Not very vigorous in CTLK93 but high yield for the first year.
- Highest yielder in STPQ94.

Experimentation could be extended and data collected from existing trials for further assessment. But this clone might not appear very performant compared with other current clones, especially for growth.

RRIV3 (LH82/158 = BK8) (RRIC110 x RRIC117)
- 9 large scale trials in Vietnam
- Abundant branching at medium height.
- Growth score : XTKT93 (4), STPQ94 (5), XTDC94 (4), CTEL97 (5), XTPQ97 (4), STHT98 (4), XTHT98 (4)
- Yield score : CTLK90 (4), STPQ94 (4)

This clone seems very interesting for growth and yield.

RRIV5 (LH82/198) (RRIC110 x RRIC117)
- Tested in 3 LSCT (CTLK90, CTMY92, CTCS93)
- Under stimulation : more information required.
- Wood value : 2 (abundant branching at a low level).
- In CTLK90 : very high yield (4 years) = 226 % of GT1, 124 % of PB235.
- Yield g/t/t = 139 % of GT1 in STPC87.
- Growth and yield are under GT1 in CTMY92
- Growth in CTCS93 is a little higher than GT1.

This clone does not seem to provide added value compared with other well known clones. But yield is gradually increasing along time. More experimentation is required for this clone.

LH82/9 (IR45 x PB235)
- Tested on 3 LSCT (CTLK89, CTKB89, CTQT88)
- Oïdium : medium-low tolerance.
- Tall tree with branching at medium height.
- In CTLK89 : kg/ha (5 years) = 111 % of GT1.
- Growth compared with GT1 : 106 % before opening and 104 % at 12 years old in CTKB89
- Yield g/t/t = 144 % of GT1 in STPC87, 112 % for 5 years of tapping in CTKB89.

This clone may not provide a new advantage compared with other current clones.

LH82/75 (RRIC110 x PB235)
- Tested in 2 LSCT (CTKB89 and CTMY88)
- Oïdium : highly susceptible
- Wood value : high (tall trunk, tall tree)
- Growth compared with GT1 : a little higher in CTKB89
- Yield compared with GT1 : 102 % for 5 years of tapping in CTKB89

*LH82/75 could be a **latex-timber** clone but its growth and yield performances are limited.*

LH83/85 (RRIC110 x PB252)
- Tested in STLK87 and CTLK96
- Yield (5 years) = 279 % of GT1, 143 % of PB235
- Growth equivalent with PB235 (103 % of PB235 in CTLK96)
- Rather low susceptibility to Oïdium

Very promising clone, more experimentation is required.

LH83/152 (VQ79 x RRIC117)
- Not yet tested in LSCT
- High vigour, yield (g/t/t = 147 % of GT1, third yielder in STPC87) and wood value, very positive visual aspect in small scale at Plei Can.

*This promising clone was found visually very impressive by the expert as a **latex-timber** clone in Plei Can. It must be tested at large scale level.*

LH83/283 (PB235 x RRIC117)
- Tested in STLK86 and STLK87
- Yield (5 years) = 193 % and 176 % of GT1, 100 % and 90 % of PB235
- Growth equivalent with PB235 before tapping, 118 % of PB235 during tapping
- Rather low susceptibility to Oïdium and Corticium

This promising clone requires more experimentation.

LH83/290 (PB235 x RRIC123)
- Highest yield in STLK90, high vigour and high yield (133 % of GT1), transfered to LSCT.
- Promising clone, comparable with PB235 for growth and yield, can be opened one year before GT1
- Good latex physiological parameters, supposed to be responsive to stimulation
- Light susceptibility to Oïdium, Phytophtora,Corticium

*To test at large scale level as a **latex-timber** clone.*

LH83/732 (PR255 x PB235)
- Not yet tested at large scale level
- First high yield (g/t/t = 160 % of GT1) and wood value in small scale at Plei Can.

*This very promising **latex-timber** clone is to be assessed at large scale level.*

LH88/61 (RRIC121 x PB235)
- Very vigorous and high yield after 2 years of tapping in small scale trial
- Good growth during tapping
- Good branching habit for latex-timber dual purpose
- Low susceptibility to leaf diseases

*This promising **latex-timber** clone is to be assessed at large scale level.*

LH88/241 (PB235 x RRIM712)
- Very vigorous and high yield after 2 years of tapping in small scale trial
- Good growth during tapping
- Good branching habit for latex-timber dual purpose
- Low susceptibility to leaf diseases

*This promising **latex-timber** clone is to be assessed at large scale level.*

The case of 5 other discarded clones

LH83/150 (VQ79 x RRIC117)
- High vigour and wood value in STPC87.
- Yield level in STPC87 seems limited
- Not tested in LSCT yet.

LH83/289 (PB235 x RRIC123)
- High vigour, yield (g/t/t = 131 % of GT1 in STPC87) and wood value in small scale at Plei Can.
- Some trees died in cold conditions in the North.
- Not tested in LSCT yet.

PB217 (PB5/51 x PB6/9)
- Tested in 3 LSCT in Vietnam (CTLK89, CTMY92, CTCS93). Most of following information is issued from Côte d'Ivoire
- Has been an important clone for a long time in Malaysia.
- Grafting may be difficult.
- In CTLK89 : nice vigour but low yield (without stimulation) and leaf diseases.
- Growth : more often equivalent to GT1, but much lower in difficult conditions.
- Growth during tapping is very good.
- Initial yield is low but it can become very high with intensive stimulation after 4-5 years of tapping.
- Adapted to very intensive stimulation with high response (physiology : poor initial activity with high sucrose reserves, very resistant to TPD).
- Dense canopy (due to rather abundant branching) but not yet in the immature period.
- Risk of wind damage : rather low (moderate height) but possible branch snap
- Wood value : high quantity of biomass due to abundant branching at a low level but short main stem.
- Very susceptible to Corynespora and Colletotrichum
- Best yielder over many years in Côte d'Ivoire with intensive stimulation. It has become also very performant in Mato Grosso with intensive stimulation (ecological conditions similar to Central Highlands of Vietnam) as well as in some estates of North-Sumatra (out of Corynespora and Colletotrichum prone areas).

Clearly, this clone (which is very important in many other areas) is not adapted to Vietnam ecological conditions as well as to socio-economic objectives (fast growth, timber value).

PB310 (PB5/51 x RRIM600)
- Tested in 5 LSCT in Vietnam (CTKB89, CTMY88, QTCP85, CTDC86, CTQT88)
- Very tall and straight trunk (possibly susceptible to wind damage).
- Wood value : high level.
- Oïdium : very good level of resistance.
- Phytophtora : very susceptible (black stripes).
- TPD : susceptibility medium but sometimes very high (QTCP85)
- Very positive visual aspect in CTKT85, CTKB89
- Growth before tapping is limited whereas growth during tapping seems interesting
- Growth compared with GT1: 103 % before opening and 102 % after 9 years of tapping in CTKT85, equivalent before opening and 108 % at 15 years old in CTDC86, equivalent before opening and 104 % at 12 years old in CTKB89
- Yield compared with GT1 : 143 % after 9 years of tapping in CTKT85 (best clone of the trial), 79 % for 7 years of tapping in QTCP85, kg/ha equivalent after 8 years of tapping in CTDC86, 106 % for 5 years of tapping in CTKB89
- Growth score : QTCP85 (3), CTKT85 (3), CTMY88 (1), CTKB89 (2), CTDC86 (2)
- Yield score : QTCP85 (1), CTKT85 (5), CTMY88 (3), CTKB89 (2), CTDC86 (2)

This clone, which has a nice visual aspect and an architecture adapted to timber use, seems limited for growth and yield. It is very susceptible to Phytophtora.

PB324 (RRIM600 x PB235) (= VM324)
- Tested in 3 LSCT in Vietnam (CTKB89, CTDC86, CTKT85)
- Oïdium : medium
- Growth before tapping is limited but growth during tapping seems good
- Growth compared with GT1 : 104 % before opening and 111 % after 9 years of tapping in CTKT85, equivalent before opening and 111 % at 15 years old in CTDC86, equivalent to GT1 in CTKB89
- Yield compared with GT1 : 112 % after 9 years of tapping in CTKT85, kg/ha after 8 years of tapping = 95 %, 87 % in CTKB89
- Growth score : STHT98 (2), CTKT85 (3), CTKB89 (1), CTDC86 (2)
- Yield score : CTKT85 (3), CTKB89 (2), CTDC86 (2)

Growth and yield seem limited for this clone.

May we have forgotten any good clone ?

Taking the initial list of 325 clones, let us examin the case of some other clones :

IRCA18 (PB5/51 x RRIM605, created in Côte d'Ivoire)
- Tested in STLK91, CTMY92, CTCS93, STPQ94, XTDC94, CTEL97, STHT98,
- Growth score : STLK91 (2), CTMY92 (1), CTCS93 (1), XTDC94 (1), CTEL97 (2), STHT98 (2), STPQ94 (1)
- Yield score : STLK91 (3), CTMY92 (1), STPQ94 (1)
- Very performant in Côte d'Ivoire (high yield with fast increase in yield).
- Growth compared with GT1: very poor in CTCS93, very poor in XTDC94
- Visual aspect very negative in CTCS93 due to poor vigour.

This clone is clearly not adapted to ecological conditions of Vietnam, probably due to its susceptibility to different leaf diseases. As well as for PB217, this case illustrates the huge differences in behaviour of the same clones in different sites, probably due to leaf diseases.

LH82/157 (RRIC110 x RRIC117)
- Growth score : XTDC94 (2), STPQ94 (1),
- Yield score : STPQ94 (3)

Limited growth, not attractive.

IRCA111 (PB5/51 x RRIM600)
- Abundant branching at a low height, heavy crown
- Very susceptible to wind damage
- Medium growth in XTKT93, poor growth in STLK91, CTMY92
- Poor yield in CTMY92

Like PB217 and IRCA18, this clone, very vigorous, high yielding but susceptible to wind damage in Côte d'Ivoire, is clearly not adapted to ecological conditions of Vietnam. This is the case of many IRCA clones. Susceptibility to leaf diseases is thought as the main reason.

PR261
- Oïdium : medium
- The trunk is not straight in CTKT85
- Growth compared with GT1 : 97 % before opening and 102 % after 9 years of tapping in CTKT85, 97 % at 16 years old in QTCP85
- Yield compared with GT1 : equivalent after 9 years of tapping in CTKT85, kg/ha = 71 % in QTCP85, kg/ha = 67 % in QTCP85

Very limited growth and yield.

PR255 (TJIR1 x PR107)
- Very good behaviour (yield) in Mato Grosso (Brasil) under ecological conditions similar to Central Highlands (but with other pathological problems)
- Oïdium : medium
- Growth compared with GT1 : 94 % before opening and 94 % after 9 years of tapping in CTKT85, equivalent before and after opening in CTDC86
- Yield compared with GT1 : equivalent after 9 years of tapping in CTKT85, kg/ha = 97 % for 8 years of tapping

Not adapted to ecological conditions of Vietnam.

PB280 (PBIG seedling)
- Yield compared with GT1 : g/t/t = 182 % in STPC87/2.
- Third highest yielder in STPQ94.
- In CTLK90 : yield (4 years) = 157 % of GT1, 87 % of PB235, very abundant and heavy branching, twisted trunk, dense canopy.
- In Côte d'Ivoire : very fast growth but heavy crown, very susceptible to wind damage. Important biomass but no timber value.

Susceptible to wind damage and probably not adapted to socio-economic objectives in Vietnam.

PR107 (primary clone)

Very slow growth and very low-increasing yield, not adapted to socio-economic objectives of smallholders. Very susceptible to Phytophtora.

RRIC103 (RRIC52 x PB86)
- Growth compared with GT1 : 107 % before opening and 106 % after 9 years of tapping in CTKT85
- Yield compared with GT1 : equivalent after 9 years of tapping in CTKT85
- Clone very susceptible to Corynespora (disaster in Sri Lanka around year 1985)
- In Côte d'Ivoire : very low-increasing yield.

Not to recommend.

RRIC105
- Oïdium : good level of resistance.
- Growth compared with GT1 : equivalent before opening and after 9 years of tapping in CTKT85, a little better in CTDC86.
- Yield compared with GT1 : 90 % after 9 years of tapping in CTKT85, kg/ha for 8 years = 78 %.
- Heavy branches.

Resistant to Oïdium but not attractive for growth and yield.

PB254 (PB5/51 x PBS/78)
- Oïdium : medium-low resistance.
- Dense canopy and good covering.
- Visual aspect rather negative.
- In CTLK89 : straight trunk.
- Growth compared with GT1 : much lower in CTKB89
- Yield compared with GT1 : 80 % for 5 years of tapping in CTKB89.

Not attractive except for canopy and covering.

RRIM725 (FX25 illegitimate = male parent unknown)
- Tall tree
- Foliage very sane in CTLK89.
- In CTLK89 : kg/ha (5 years) = 107 % of GT1.
- Growth compared with GT1 : lower in CTKB89
- Yield compared with GT1 : g/t/t = 114 % in STPC87, 76 % for 5 years of tapping in CTKB89
- Corynespora : very susceptible in Malaysia (discarded from recommendations for that reason)

Not attractive.

RRIC117
- Oïdium : medium
- Growth compared with GT1 : a little better than GT1 in CTDC86
- Yield compared with GT1 : 111 % for 8 years of tapping in CTDC86

Not bad but not very attractive compared with other clones.

RRIC132 (Wickham x benthamiana)
- In CTLK89 : highest yielder but very bad architecture and wind damage.
- In Gabon : very resistant to Colletotrichum but very low yield

Not attractive.

HAIKEN1
- Oïdium : medium
- Growth compared with GT1 : a little better than GT1 in CTKB89
- Yield compared wth GT1 : 55 % for 5 years of tapping in CTKB89

Very low yield.

SCATC88/13
- Rather short tree, rather large crown
- Growth compared with GT1 : lower in CTKB89
- Fourth highest yielder in STPQ94
- Yield compared with GT1 : 77 % for 5 years of tapping in CTKB89

Not attractive.

LH82/8 (IR45 x PB235)
- Very good growth in STPQ94
- Yield a little higher than GT1 in STPQ94

Limited yield.

LH82/130 (RRIC105 x PB235)
- In CTLK90 : yield (4 years) = 158 % of GT1, 87 % of PB235.

Maybe interesting.

LH82/159 (RRIC110 x RRIC117)
- In CTLK90 : yield (4 years) = 98 % of PB235, 177 % of GT1, very high, wood value.
- Susceptible to Corticium.

Limited by Corticium.

LH82/162 (RRIC110 x RRIC123)
- In CTLK90 : yield (4 years) = 156 % of GT1, 86 % of PB235.

Maybe interesting.

LH82/171 (RRIC110 x PB235)
- In CTLK90 : yield (4 years) = 156 % of GT1, 86 % of PB235.

Maybe interesting.

LH82/213 (RRIC110 x RRIC117)
- In CTLK90 : yield (4 years) = 86 % of GT1, 47 % of PB235, very bad architecture.

Very poor yield and bad architecture.

LH83/93 (RRIC110 x RRIC114)
- In CTLK89 : kg/ha (5 years) = 150 % of GT1.

- Susceptible to wind damage
- Medium growth

Limited by growth and wind damage.

PBIG9/31

- In CTLK89 : medium behaviour, yield higher than GT1.

Not attractive enough.

PBIG21/1

- In CTLK89 : medium behaviour, yield a little higher than GT1.

Not attractive enough.

None of these 24 clones deserves enough interest with view to possible future recommendations in Vietnam.

Appraisal on the quality of research and clonal studies made by RRIV

The whole of the visited experimentation has been set by the RRIV Breeding Group, often with cooperation of Geruco and sometimes of other institutions (Phu Quy Fruit Research Center in Nghe An province for instance).

The quality of the clonal experimental network and of the collection of data was found very good. Setting the trials at a long distance from the Centre of RRIV was not an easy work, especially with very limited means available ; however, Vietnam now has a good basis for clonal recommendations. Many documents have been written, in Vietnamese and in English languages, about the results of the experimentation. Clonal recommendations with risk levels (3 classes) for the different ecological areas of Vietnam have been regularly up-dated since 1997.

The quality of clonal creation and selection made in RRIV-Lai Khê also seems very good, with pragmatic views and rigorous procedures. Researchers are fully accustomed to frequent visits to the fields and have a good memory of their observations and of the behaviour of their genetic material.

In only 2 weeks and just with visual observations, the expert, whose knowledge and abilities were mainly based on outside experience, would not have been able to make proper recommendations for Vietnam. As a consequence, the elements provided by the expert had to integrate the results and data collected by the RRIV Breeding Group, and to take into account their own views, especially for assessing clonal susceptibilities to leaf diseases. This could be done with a high level of confidence. However, the expert is also using his own experience so as to provide an independant assessment which can be complementary to RRIV's deep-rooted local experience.

Elements for up-dating clonal recommendations in the second phase of ADP project

The process used for building a recommendation during the mission

After having visited the trials, the RRIV Breeding Group and the expert had discussions for selecting a set of clones which can be candidates for recommendation. They agreed on the choice of 12 clones (GT1, PB235, RRIM600, PB260, RRIC110, RRIV2, RRIV4, RRIC121, RRIC100, RRIM712, PB255, LH82/92), after having discarded VM515.

For adapting the choice of clones to the different ecological areas, Coastal Provinces were first distinguished between Southern, Central and Northern Coastal Provinces. But it fastly appeared that the choice of clones in Coastal Provinces was strongly constrained by wind risk, with no other possibility for now that limiting the recommendations to the most secure clones. Consequently, Coastal Provinces are considered as one sole ecological area (although there are big differences in growth rate due to latitude).

After discussions, the RRIV Breeding Group and the expert agreed on a proposal which was submitted to the ADP Meeting in Hué on December 14, 2001.

This proposal was the following :

Binh Thuan (South) : PB235, RRIV2, RRIV4 (class 1) + PB260, RRIC121 (class 2).

Central Highlands, favorable areas : PB260, RRIM600, PB235, RRIV4 (class 1) + RRIC121, RRIC110, RRIV2 (class 2).

Central Highlands, less favorable areas : GT1, PB260, RRIM600 (class 1) + RRIC100, RRIC110, RRIV2, LH82/92 (class 2).

Coastal Provinces : GT1, RRIM600, PB255 (class 1) + PB260, RRIM712, RRIV2, RRIC100 (class 2).

The proposal of PB260 and RRIV2 in class 2 for Coastal Provinces was assorted with the advice to open these vigorous clones at trunk girth of 55 cm, so as to reduce wind risk on them.

The main critics to this proposal were that :

- the proposed diversification was impossible to implement in the framework of ADP project
- the advice to open some clones later would not be followed.

Proposal of the expert after considering the elements collected during the mission

The personal opinion of the expert is made of the following elements :

- Clonal recommendation to ADP project must propose at least 2 clones for each ecological area

- GT1 and RRIM600 can be used everywhere in Vietnam but growth and yield performances may not be as high as for other clones in many cases. Growth is rather low, architecture is not optimal for timber use.

- PB235, PB260, RRIV2, RRIV4 can be « latex-timber » clones well suited to the increasing dual purpose of rubber in Vietnam, and with high performances.

- It is not very useful to jointly recommend PB235 and PB260 in one same area. The expert is more confident on PB235 with exception for less favorable areas of Central Highlands where PB260 is probably better.

- RRIC110 cannot be recommended out of Central Highlands (the only area where we think that there is no wind risk). For limiting clonal diversification in ADP project, we did not maintain the recommendation of this clone.

- RRIC121 is interesting for growth (before and during tapping) but yield potential must be confirmed on the long term. Due to its growth, it may be a diversification clone (with rather low risk) for Coastal Provinces (not recommended yet, but possible testing with farmers in a participative way).

- We know that PB255 has a high yield potential but growth does not seem steady and low grafting sucess rate may be a problem.

- RRIV4 is a very interesting clone but with wind risk in the South, so more adapted to favorable areas of Highlands (to be strictly excluded from Coastal Provinces).

- LH82/92 would require more experimental information and might be interesting for « latex-timber » dual purpose.

- RRIC100 may be very interesting for leaf diseases tolerance but its interest for growth and yield is not fully demonstrated yet, and grafting success rate may be a problem for a « smallholders »' project. However, much attention has to be paid to this clone in the future years.

- The advantages of RRIM712 are not demonstrated.

Consequently, the clonal recommendation proposed by the expert, based on following 6 clones :

GT1, RRIM600, PB235, PB260, RRIV2, RRIV4

is :

Binh Thuan (South) :	**PB235, RRIV2**	(+ PB260, RRIM600, GT1)
Central Highlands, favorable areas :	**PB235, RRIV4**	(+ PB260, RRIM600, GT1
Central Highlands, less favorable areas :	**PB260, RRIV4**	(+ RRIM600, GT1)
Coastal Provinces :	**GT1, RRIM600**	**(+ RRIV4)**

✏ It is underlined that among these 6 clones, 4 have fast growth and may be considered as « latex-timber » clones (PB235, PB260, RRIV2, RRIV4).

Main characteristics of clones proposed to ADP project for recommendation

(1 = poor; 5 = very good)

	GT1	RRIM600	PB235	PB260	RRIV2	RRIV4
Security	5	5	4	3	4	3
Adaptation						
Binh Thuan	2	3	4	3	4	3
Highlands (favorable)	2	3	5	4	4	5
Highlands (less favorable)	4	4	2	5	3	4
Coastal Provinces	5	5	1	1	3	1
Growth and yield						
Growth before tapping	2	1	5	4	5	5
Growth during tapping	1	3	3	3	3	3
Yield (first 5 years period)	2	3	5	5	4	5
Yield (second 5 years period)	2	3	3	3	4	3
Yield (third 5 years period)	2	3	2	2	?	?
Timber value	3	2	5	5	5	5
Grafting success rate	5	5	4	5	4	4
Susceptibility						
Wind	3	4	1	1	4	2
TPD	3	2	1	1	3	3
Oïdium	3	5	1	4	3	3
Phytophtora	3	2	4	4	3	3
Corticium	5	2	3	5	2	3
Corynespora	5	2	4	1	?	?
Cold and dry season	5	5	2	4	3	3

✏ The case of RRIC100 (tested only in 3 trials, not included in those recommendations) has been discussed. This clone appears to be resistant to many leaf diseases in the fields. Moreover, it is fast growing. But yield is not higher than for GT1. Low grafting sucess rate is also a negative aspect for implementation in the framework of a smallholders' project. Experimentation of this clone needs to be emphasized.

✏ The case of RRIC121 (tested only in 4 trials, not included in those recommendations) has also been examined. As a fast growing clone, before and during tapping, this clone might be wind resistant and consequently fitted to Coastal Provinces. Yield is supposed to increase progressively. Experimentation of this clone needs to be specifically emphasized in wind prone areas, in controlled conditions as well as in multilocal farmers' plots, in a participative way.

✏ RRIV2, belonging to the 6 recommended clones, is growing very fast, yield is rather high and no sign of wind susceptibility has been observed yet. As a latex-timber clone with early opening (at least one year before GT1 and RRIM600), it can be used without any restriction in the South. We suggest to initiate its development in Coastal Provinces. We also suggest to compare 2 girth sizes for opening this clone: 50 cm (standard) and 55 cm (delayed opening, but not later than GT1 or RRIM600, with improved rigidity and better resistance to wind damage).

✏ RRIV2 and RRIC121 may be the 2 clones more able to improve performances with low risk in Coastal Provinces, when compared with GT1 and RRIM600. Conversely, PB235, PB260 and RRIV4 have to be strictly excluded in this area.

✏ RRIV4, with some proven susceptibility to wind damage, can be widely planted in Central Highlands.

✏ Among the clones examined, the following 15 clones can be considered as « latex-timber » clones due to their fast growth and to their architecture made of one main dominant stem with light secondary branches : PB235, PB260 RRIV2, RRIV4, LH82/92, PB312, PB330, IRCA130, IRCA230, LH82/75, LH83/152, LH83/290, LH83/732, LH88/61, LH88/241.

✏ Among the 19 promising clones which were listed for further large scale experimentation, the expert underlines his interest for :

- 4 clones which could be considered for Highlands only : PB312, PB314, PB330 and IRCA130. All of them are very susceptible to wind damage. Three of them are **latex-timber** clones : PB312, PB330 and IRCA130.

- the 6 following **latex-timber** clones : IRCA230, LH83/152, LH83/290, LH83/732, LH88/61 and LG88/241

- the 2 clones IRCA331 and RRIV3.

Elements for following-up action and experimentation

Quality of planting material

One important point for ensuring profitability of smallholdings is to help reducing the non productive period. This can be achieved by the choice of fast growing clones, by the adequate use of fertilizers and cover crops, by appropriate weeding, etc. The production of grafted plants of good quality, with rigorous selection at every stage, is one of these important factors. ADP project produces polybags plants and ground stumps.

For ground stumps, it seems that one year old stumps are more and more used. One reason for that is that it seems difficult to plan the production of plants with a foreview of 2 years. The expert didn't have the opportunity to examin such one year old plants. However it seems improbable that a sufficient size of the plants can be achieved in less than 2 years growth unless a drastic selection is made in the nursery after extraction of the ground.

Experimental demonstration of the impact of the initial size of grafted plants on the growth of the trees could be one of the tasks of the Research Component.

Further experimentation

Continuing the collection of data on existing trials

An important investment has been made for setting the existing clonal trials network. It is very important to continue collecting growth and yield data, as well as diseases observations (at least for 10-15 years) on all these trials so as to have a view which can be representative of the whole economic cycle.

As an example, the older LSCT in Côte d'Ivoire was planted in 1974. We so have yield data for 23 years. So, we can be sure that PB235 has a cumulated yield not lower than GT1 although PB235 was severely affected by wind damage and TPD.

The objective of these trials are not only to classify clones so as to recommend the best ones, but also to collect data series over long periods of time with different genotypes (with different types of problems) in different environments. These data will be useful in the future for simulating economic profitability of different situations based on accurate agronomic data.

Introducing intensive stimulation in large scale clonal trials

Introducing intensive stimulation in large scale clonale trials, after 3 to 5 first years of tapping is recommended, so as to be able to assess the specific behaviour of clones under stimulated tapping. This information will help to consider the reduction of tapping frequency (to d/4 or d/5) for reducing tapping costs and increasing profitability of the plots. Association of latex diagnosis to these stimulated trials will help to draw interpretation about the metabolic behaviour of clones. But introducing stimulation in the trials will require to adapt the production control system. The best system might be to collect fresh coagulated rubber from

cups after each tapping and to keep the yield from each plot in some area safe from robbery risk, for monthly weighing.

We think that clonal experimentation under intensive stimulation is more informative than without any stimulation : as a matter of fact, the weaknesses of clones can be cleared only under the pressure of intensive exploitation.

Setting new trials for assessing promising clones

We may consider that existing trials are numerous enough for accurate assessment of clones PB255, RRIM712, RRIC110 and IRCA230 which could be recommended to smallhoders in the future.

New large scale trials would be necessary for improving the level of knowledge on promising clones such as RRIC121, RRIC100 and LH82/92 (first priority) and for PB312, PB314, PB330, IRCA130, IRCA331, RRIV1, RRIV5, LH83/85, LH83/152, LH83/283, LH83/290, LH83/732, LH88/61 and LH88/241.

Setting « smallholders' demonstration plots » for recommended clones

In each ecological area, contracts would have to be established with a set of smallholders for planting on « side by side » plots (5 lines for each clone, without replication plots) the different recommended clones fitted with the local ecological area :

Binh Thuan :	GT1, RRIM600, PB235, RRIV2, RRIC100, RRIC121
Highlands (favorable area) :	GT1, RRIM600, PB235, RRIV4, PB260, RRIC100
Highlands (less favorable area) :	GT1, RRIM600, PB260, RRIV2, RRIV4, RRIC100
Coastal Provinces :	GT1, RRIM600, RRIC100, RRIC121 + 2 plots of RRIV2 (2 girth standards for opening RRIV2)

The main interest of these demonstration plots is to provide the farmers with the possibility to come and observe, in some smallholders' contexts, an extended sample of clones which could be used for clonal diversification. These tests will become tools to be used by the extension services.

Suggestions for establishing contracts with farmers have been presented by Jean-Marie Eschbach (ADP Mission report of November 2000, Appendix 6 and 7. We may suggest that these contracts will be established first for the non productive period, up to the opening of the first trees, with free provision of grafted plants to the farmer. The financial value of the plants, as well as of other advantages provided to the farmer would have to be clearly established for reimbursement if the plot was to be left unattended within 4 years after planting.

Then, at opening of the test, the contract would have to be continued for 3 years with agreement of both parties (project or any institution and the farmer) on new bases related with tapping and yield control. Afterwards, contracts would have to be continued for periods of 3 years with up-dated specifications.

Adaptation to wind prone areas

The main limitation of the hereafter proposed clonal recommendation is related with a rather limited choice for Coastal Provinces (GT1, RRIM600, RRIV2 on small areas for the next following years), due to wind risk in this area, even if we consider that the risk is reduced on sites at a reasonnable distance from the seaside). GT1 and RRIM600 have only a moderate growth.

For new fast growing « latex-timber » clones, adaptation to wind prone areas with reduced risk would imply that the girth size for opening the trees can be modified from 50 cm to a larger girth such as 55 cm (around 1 to 1,5 years more for the immature period of the clone but this can be not much different from the date of opening of GT1 or RRIM600).

It is so suggested to search for plots of clones PB260 or PB235 already set in Coastal Provinces and not opened yet, vith view to split some of these plots in 2 parts and to delay opening on one of these parts.

Another suggestion is to contract with 1 or 2 Geruco estates in Coastal Provinces for setting a clonal trial with 4 replications (GT1, RRIM600, RRIC121, PB235, PB260, RRIV2, RRIV4), with each plot splitted in 2 parts (opening 1./ at 50 cms girth and 2./ at 55 cms girth).

For information, we indicate that a world famous research team, based in United Kingdom (Edinburgh-Scotland) is specialized on the assessment and geographic mapping of wind risk areas depending on climate, topography and vegetation (B.A. Gardiner, M.P. Coutts, A.D. Milner, B.C. Nicoll, C.P. Quine, C. Walker, Forestry Authority, Northern Research Station, Roslin, Midlothian EH25 9SY, United Kingdom, cf in references).

Mechanistic research on « wind and rubber tree » would be a useful research topic, never done yet.

Breeding

A lecture has been given by the expert to RRIV Breeding group (December 17, HCMC) on his views about the main trends in rubber breeding.

The main points were about :

- the interest of splitting the Wickham population in 2 genetic groups for a better management of genetic variability (cf Appendix).

- the need for assessing biomass volume and timber volume for promising clones under selection, with view to providing « latex-timber » clones

- the importance of assessing carefully the yield potential of the full sib families and to practise combined « family x individual » selection rather than individual selection only

- the potential interest of choosing one very good family for growth, yield and timber value so as to apply selection on a wide number of progenies (200-300 genotypes) from this family. Making the genetic map of such a family in the future could be also valuable

- the potential interest of developping a specific selection based on Oïdium resistance, related with phytopathologic analysis of host-pathogen (Hevea-Oïdium, clones-strains) interaction

- the potential interest of microsatellites, as very efficient genetic molecular markers for clonal identification applied to rubber budwood gardens, parentage identification and use of natural pollination for recombining many genitors. Since this mission and at the time of editing this report, a Cirad grant has been obtained for a 6 weeks training period of one RRIV researcher in Cirad at Montpellier about this technique.

Names of Vietnamese clones

All genotypes created in RRIV (Lai Khê Centre) are named LH, followed by the year of hand pollination, then followed by the position figure of the mother-tree in the Seedling Evaluation Trial where this mother-tree is evaluated.

Example : LH82/92 (created by hand-pollination in 1982).

For the clones reaching large scale experimentation level, a code with « « RRIV + figure » was started. 5 clones are now becoming popular under the following names :

LH82/122	:	RRIV1
LH82/156	:	RRIV2
LH82/158	:	RRIV3
LH82/182	:	RRIV4
LH82/198	:	RRIV5

But these RRIV names have been criticized, based on the fact that RRIV is an « English-speaking » acronym. It has been asked to adopt a « Vietnamese-speaking » acronym. The expert underlines the fact that it seems actually necessary to adopt an easy-to-remember « development name », acceptable by everybody in Vietnam, for Vietnamese clones which are to be recommended and used by farmers.

Conclusion

The main conclusions of the mission are formulated in the executive summary of this report. They may be discussed by ADP Research Component and at the level of the Research Component Working Group for adapting them and providing ADP/PCU with up-dated guidelines to be used for the implementation of the project.

The choice here made of fast growth and fast yielding « latex-timber » clones associated with enough knowledge and security on these clones (to some extent) would have to be confirmed.

I can certificate the very good quality of the quantitative data and qualitative information collected, analysed, formulated and provided by the RRIV Breeding Group. Those data are perfectly adequate for the formulation of clonal recommendations adapted to the needs of rubber planters in Vietnam.

It must be underlined that knowledge is never sufficient to provide a definite information. Some elements depend on assessment of risks (storms, diseases, interaction of rubber with climate and soil). Every year brings new elements from the trials for adapting the choice of clones. This can comply with the fact that diversification can be thought easier and safer by changing some clones every 3 years rather than implementing many different clones in the same time.

It is hoped that this report will be beneficial to the implementation of ADP project and to Vietnamese farmers.

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APPENDIX

Parentage of the recommended or promising clones in Vietnam

	Origins	
	Female	**Male**
GT1 (primary clone)	GT1	
PB235 (PB5/51 x PBS/78)	PB56, PB24	PBS/78
RRIM600 (TJIR1 x PB86)	TJIR1	PB86
PB260 (PB5/51 x PB49)	PB56, PB24	PB49
RRIC110 (LCB1320 x RRIC7)	LCB1320	RRIC7
RRIC121 (PB28/59 x IAN873)	PB28/59	PB86, FA1717
RRIV2 (RRIC110 x RRIC117)	LCB1320, RRIC7	RRIC117
RRIV4 (RRIC110 x PB235)	LCB1320, RRIC7	PB56, PB24, PBS/78
RRIC100 (RRIC52 x PB86)	RRIC52	PB86
RRIM712 (RRIM605 x RRIM71)	TJIR1, PB49	RRIM71
PB255 (PB5/51 x PB32/36)	PB56, PB24	PB32/36
LH82/92 (RRIC110 x RRIC123)	LCB1320, RRIC7	PB86, F409, CH26
PB312 (RRIM600 x PB235)	TJIR1, PB86	PB56, PB24, PBS/78
PB314 (RRIM600 x PB235)	TJIR1, PB86	PB56, PB24, PBS/78
PB330 (PB5/51 x PB32/36)	PB56, PB24	PB32/36
IRCA130 (PB5/51 x IR22)	PB56, PB24	AVROS163, WAR4
IRCA230 (GT1 x PB5/51)	GT1	PB56, PB24
IRCA331 (GT1 x RRIM600)	GT1	PB86, TJIR1
RRIV1 (RRIC110 x RRIC117)	LCB1320, RRIC7	RRIC117
RRIV3 (RRIC110 x RRIC117)	LCB1320, RRIC7	RRIC117
LH82/9 (IR45 x PB235)	IR45	PB56, PB24, PBS/78
LH82/75 (RRIC110 x PB235)	LCB1320, RRIC7	PB56, PB24, PBS/78
LH83/152 (VQ79 x RRIC117)	VQ79	RRIC117
LH83/290 (PB235 x RRIC123)	PB56, PB24, PBS/78	PB86, F409, CH26
LH83/732 (PR255 x PB235)	TJIR1, PR107	PB56, PB24, PBS/78
LH88/61 (RRIC121 x PB235)	PB28/59, PB86, FA1717	PB56, PB24, PBS/78
LH88/241 (PB235 x RRIM712)	PB56, PB24, PBS/78	TJIR1, PB49, RRIM71

Suggestion for splitting the Wickham population in 2 groups of genitors :

Group W1 : TJIR1, PB86, GT1, LCB1320, RRIC7, PB28/59, RRIC117, RRIC52, RRIM71, RRIC123, VQ79, PR107, including following clones : RRIM600, IRCA331, RRIC110, RRIV1, RRIV2, RRIV3, RRIC100, LH82/92, LH83/152, PR255

Group W2 : PB56, PB24, PB49, PBS/78, PB32/36, AVROS163, WAR4, IR45, including following clones : PB5/51, PB235, PB255, PB260, PB330, IR22, IRCA130, LH82/9.

Clones issued from W1 x W2 crosses (not to be used again as genitors) : PB312, PB314, RRIM605, RRIM712, IRCA230, RRIV4, LH82/75, LH83/290, LH83/732, LH88/241.

RRIC121 and LH88/61, issued from IAN873 (Wickham x Amazonian clone) are not strictly Wickham clones.