

AN IPARD-CIRAD COOPERATION ON

RRII program of

*MULTILOCATION TRIALS NETWORK FOR RUBBER CLONAL  
RECOMMENDATIONS IN VARIOUS AGROCLIMATIC CONDITIONS OF  
INDONESIA*

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*CERTIFIED BUDWOOD STICKS PRODUCTION FOR THE MULTILOCATION  
CLONE TRIALS NETWORK PROJECT FOR CLONAL RECOMMENDATIONS*

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Eric Penot and Thomas Wijaya  
(Balai Penelitian Sembawa/CIRAD)  
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# **CERTIFIED BUDWOOD STICKS PRODUCTION FOR THE MULTILOCATION CLONE TRIALS NETWORK PROJECT FOR CLONAL RECOMMENDATIONS**

## *Table of content*

### *Introduction*

- 1) *the establishment of new small budwood gardens, named as "First level budwood garden", with budwood sticks coming from the collection budwood gardens of Sembawa and Sungei Putih.*
- 2) *To certify at 100 % the clonal purity, we suggest to identify 10 to 15 % of the plants in the First level budwood gardens using electrophoresis analysis.*
- 3) *The establishment of the multiplication budwood gardens :*

### **ANNEXES**

#### **ANNEX 1**

#### **IMPLEMENTATION OF FIRST LEVEL BUDWOOD GARDEN IN SEMBAWA**

*The selected clones*

*Area of the first level budwood garden in Sembawa*

*Cost of establishment*

*Date of implementation*

## ANNEX 2

### CLONE IDENTIFICATION AND CONTROL USING ELECTROPHORESIS TECHNIQUE (PORTABLE ELECTROPHORESIS LABORATORY OF CIRAD).

*Objective*

*Date of implementation*

*Implementation*

*- 1 - control of first level budwood garden*

*- 2 - Additional Analysis (from the experience of the previous mission of april 1992)*

*Conditions of implementation*

*Cost*

*Expected output*

## ANNEX 3

### ESTABLISHMENT AND COST OF MULTIPLICATION BUDWOOD GARDENS

*The selected clones*

*Area and location of the mutiplication budwood gardens*

*Cost of establishment*

*Date of implementation*

# **CERTIFIED BUDWOOD STICKS PRODUCTION FOR THE MULTILOCATION CLONE TRIALS NETWORK PROJECT FOR CLONAL RECOMMENDATIONS**

## ***Introduction***

The network of trials of the project will include up to 21 different clones, in various type of trials (see the document "Methodology of the project"). All trials are long term trials. The clonal recommendations, at the national level, will be based on the analysis of the performances of each clone, depending on agro-ecological zones and type of management (Estate or smallholders).

Therefore, it is necessary to guaranty the clonal purity of the planting material used in these trials, in order to provide accurate and useful information on clone performances.

We suggest the following methodology, in order to provide the fully certified required planting material :

- ***1) the establishment of new small budwood gardens, named as "First level budwood garden", with budwood sticks coming from the collection budwood gardens of Sembawa and Sungei Putih.*** These first level budwood garden should be made in Sembawa, (and Sungei Putih , possibly) under the control of both Research Stations.

These first level budwood gardens will permit to provide enough fully certified planting material for the implementation of "multiplication" budwood gardens (or "Second level" budwood gardens), these later located close to the trials fields. These multiplication budwood gardens should provide enough planting material for the planting of the trials, during the first 3 or 4 years of the project. They may be used later to provide estates or projects with adapted and certified planting material, or for other research trials.

These first level budwood garden can be considered as a "first supply budwood collection" of the most valuable clones (see Table 2 the list of the 21 clones), interesting for rubber production under various conditions, with a scale large enough to permit the establishment of future "multiplication budwood garden" elsewhere it is required. The current collection of clones is mainly aimed for plant breeding purpose. These first level budwood garden will be aimed for future development and certified clonal budwood availability and supply, with the selected number of clones, considered as potentially interesting for production.

It is recommended, in a first stage, to establish in 1994, one first level budwood garden in Sembawa, and to transport the required budwood sticks (from 5 clones) from Sungai Putih. See the annex 1 for further information.

*-2) To certify at 100 % the clonal purity, we suggest to identify 10 to 15 % of the plants in the First level budwood gardens using electrophoresis analysis.*

This means it is absolutely necessary to schedule a second mission of the CIRAD portable electrophoresis laboratory.

It is supposed that the collection budwood gardens are pure. The best should be to test all trees (10 per clones in every collection). Unfortunately, the project timetable requires that budwood sticks should be available as soon as possible, for the implementation of the multiplication budwood gardens for the trials. The first solution is to check the collection before cutting time in April 94. The other solution, assuming that the budwood collection should be pure, is to check the first level budwood garden, in september 1994. We suggest the second solution.

A sample of the first level budwood garden may be checked using electrophoresis techniques (10 to 15 %) and the rest with visual checking. The result of the previous mission showed that the technicians of Sembawa are very good for that purpose, at the condition that there is a few number of errors (less than 20 %).

See in annex 2 the terms of reference of the mission.

An other output of this mission should be the transfer of technology of electrophoresis technique and method of analysis to the teams of Sembawa and Sungai Putih, in order to give the possibility for RRII to implement research activities on clonal purity in the future, or to provide clonal identification service to estates and projects.

It can be found in the annex 1, the requirements for the implementation of first level budwood garden in Sembawa, and in the annex 2 : the characteristics, and requirements for a CIRAD portable electrophoresis laboratory mission.

- 3) *The establishment of the multiplication budwood gardens :*

As explained in 1), these multiplication budwood gardens will provide enough certified planting material for all the trials of the network.

Requirements and costs are presented in annex 3



***ANNEX 1***

***IMPLEMENTATION OF FIRST LEVEL BUDWOOD GARDEN IN SEMBAWA***

## **ANNEX 1**

### **IMPLEMENTATION OF FIRST LEVEL BUDWOOD GARDEN IN SEMBAWA**

Each collection budwood garden of both Sembawa and Sungei Putih have 10 trees per clones. The following table (Table 1) shows the number of trees expected per clones and per year :

Table 1

ITEMS		Number of plants
10 trees	20 meters of budwood sticks	200 buds
Bud grafting	70 % of success	140 trees
Effectively grown and selected in the field	80 % of success (elimination of poor planting material)	112 trees

#### ***The selected clones***

The 21 clones selected for the trials are presented in the Table 2.

#### ***Area of the first level budwood garden in Sembawa***

The Sembawa budwood garden will have 21 clones, with a minimum of 110 trees per clones, so 1760 trees from the 16 clones available from Sembawa collection, and 550 trees from the 5 clones available in the Sungeri Putih collection. The total number of trees is expected to be 2310 (more if success rate of grafting and other operations are better than those selected). The area of the budwood garden should be around 2700 m<sup>2</sup>.

It is recommended to establish, later, the same first level budwood garden in Sungei Putih.

#### ***Cost of establishment***

The total cost of establishment of the first level budwood garden of Sembawa is presented in the Table 3.



### ***Date of implementation***

In order to gain time in the process of budwood production, and to increase the certified budwood availability to the required level for the trials, it is suggested to implement as soon as possible the first level budwood garden, in Sembawa. It seems that rootstocks may be available in Sembawa. It has to be defined for Sungei Putih. The cutting is traditionally made in Sembawa in April, so budwood is available in January for brown budding. We suggest to do the planting in January 1994, in order to be able to provide budwood sticks from this budwood garden in October 1994, for the planting of the multiplication budwood garden (the possible location of the multiplication budwood garden are presented in annex 3).

**Table 2 CLONES SELECTED FOR THE TRIALS AND AVAILABILITY.**  
**AVAILABILITY DEPENDING ON LOCATION / SUNGAI PUTIH OR SEMBAWA**

CLONES	TYPE OF TRIAL				RESEARCH STATION	
	CFT	MFT	EPFT	OFT	SUNGEI PUTIH	SEMBAWA
BPM 1	X	X				X
BPM 24	X	X	X	X		X
BPM 107	X				X	
PB 217	X	X	X	X	X	
PB 235	X	X	X		X	
PB 255	X					X
PB 260	X	X	X	X		X
PB 280	X					X
PB 314	X				X	
PB 330	X				X	
PR 107			X			X
PR 255	X					X
PR 261	X	X	X			X
PR 300	X					X
PR 303	X					X
GT 1	X		X			X
RRIM 600			X			X
RRIC 100	X	X				X
RRIC 110	X	X	X			X
TM 5	X	X				X
TM 6	X	X	X			X
TM 8	X	X				X
TM 9	X	X				X
Number of clones	21	12	10	3	5	16

FT = CLONE FIELD TRIAL, MFT = MONOCLONAL FIELD TRIAL, EPFT = ENVIRONMENTAL ASSESSMENT OF CLONE PERFORMANCE FIELD TRIAL, OFT = On Farm TRIAL

**Tables 3 :**

**Table 3. COST OF ESTABLISHMENT OF FIRST LEVEL BUDWOOD GARDENS  
IN SEMBAWA AND/OR IN SUNGAI PUTIH (FROM THE COLLECTION  
BUDWOOD GARDENS)**

TABLE 3.1

## COST ESTIMATE PER HA

## BUDWOOD GARDEN ESTABLISHMENT : UNIT COST, 1993

BALAI PENELITIAN SEMBAWA

YEAR 0

ACTIVITIES	COST in Rp	MATERIALS TOOLS	UNIT	N° UNIT	UNIT COST	COST RP
B Labor		A 1 Materials	piece			
Land preparation	90 000	fencing material			375 000	375 000
Lining and holing	320 000	planting material	piece	10 000	600	6 000 000
Planting/supplying	240 000					
Planting control	35 000					
fertilizing (3 times)	15 000	Total A1				6 375 000
Fencing,	200 000					
Maintenance/weeding	30 000	A 2 Pesticides			100 000	100 000
Pest & diseases control	30 000					
Pruning	10 000	A 3 Fertilizers				
Cuting of budwood sticks	16 000					
Monitoring and control	240 000	Urea	Kg	209	230	48 070
		TSP	Kg	240	290	69 600
Total B Labor	1 226 000	KCL	Kg	240	290	69 600
		Total A 3				187 270
		A 4 Herbicides	Lt	6	15 000	90 000
		A 5 Transport of materials				66 000
		Total A1+A2+A3+A4				6 818 270
TOTAL LABOR COST	1 226 000	TOTAL COST A + B				8 044 270

Remarks : no cost of land renting, located inside Balai Penelitian Sembawa

Source : Sinung Hendrahno, BPS, 1993, adapted.

For a budwood garden of 8000 plants/ha.

Similar cost estimated for Sungai Puthi Research Station

TABLE 32  
COST ESTIMATE PER HA  
BUDWOOD GARDEN  
BALAI PENELITIAN SEMBAWA

: UNIT COST, 1993

YEAR 1

ACTIVITIES	MANDAYS	MATERIALS TOOLS	UNIT	N° UNIT	UNIT COST	COST RP
B Labor		A 1 Materials				
Weeding	20 000	Herbicide	Lt	4	20 000	80 000
fertilizing	15 000	Tar/parafin				10 000
Pest and diseases control	20 000	Total A1				90 000
Budwood cutting	32 000	A 2 Pesticides			100 000	100 000
Transport	42 000	A 3 Fertilizers				
Control and monitoring	240 000					
Total B Labor	369 000	Urea	Kg	321	230	73 830
		TSP	Kg	360	290	104 400
		KCL	Kg	360	290	104 400
		Total A 3				282 630
		Total A1+A2+A3				472 630
TOTAL LABOR COST	369 000	TOTAL COST A + B				841 630

Source : Sinung Hendrahno, BPS, 1993, adapted.

TABLE 33  
BUDWOOD GARDEN : COST PER METRE  
Constant price

YEAR	COST/HA	PRODUCTION METER/HA	COST/METRE (RP)	AVERAGE PRICE /M
Y0	8 044 270			
Y1	841 630	7 200	1234,15	
Y2	841 630	14 400	508,65	
Y3	841 630	21 600	254,32	
Y4	841 630	21 600	169,55	
Y5	841 630	21 600	127,16	
Total	12 252 420	86 400		
Average cost on 5 years *			142	

Year 1 to 5 = Year 1

\* Including year0

Cost price for a certified meter of budwood garden : 142 Rp

Average cost for 5 years. No land clearing, no land renting

Balai Penelitian Semabawa

Source : Sinung Hendrahno, BPS, 1993, adapted.

TABLE 3.4

**COST OF ESTABLISHMENT OF FIRST LEVEL BUDWOOD GARDENS  
IN RESEARCH STATIONS OF RRII**

**SEMBAWA**Implementation of a 2 700 m<sup>2</sup> first level budwood garden

Cost of establishment for 1 ha	8 885 900	Rp
Cost of establishment for 2 700 m <sup>2</sup>	2 399 193	Rp
Transportation cost for budwood sticks with one technician or researcher		
Fare Medan/Palembang (go and return)	600 000	Rp
Extra charge for sticks (30 KG)	90 000	Rp
Material for clone identification	100 000	Rp
<b>TOTAL COST</b>	<b>3 189 193</b>	<b>Rp</b>

No land clearing, no land renting in the cost calculation)

The first level budwood garden is located inside the Research Station.

Source : Sinung Hendrahno, BPS, 1993, adapted.

This cost is scheduled for the 1994 budget.

Date of establishing : January 1994

Tableau pour annexe 3



**ANNEX 2**

***CLONE IDENTIFICATION AND CONTROL USING ELECTROPHORESIS  
TECHNIQUE (PORTABLE ELECTROPHORESIS LABORATORY OF CIRAD).***

## **ANNEX 2 CLONE IDENTIFICATION AND CONTROL USING ELECTROPHORESIS TECHNIQUE (PORTABLE ELECTROPHORESIS LABORATORY OF CIRAD).**

The main characteristics of the CIRAD portable electrophoresis laboratory are presented in the next pages.

### **Objective :**

- 1 - Control and clonal identification of the collection budwood gardens in Sembawa and Sungei Putih, if the mission is possible before April 1994, or :
- 2 - Control and clonal identification of the first level budwood garden in Sembawa (new budwood garden to be established).
- 3 - Transfer of technology and training of teams from Sembawa and Sungei Putih. This transfer of technology should lead to the creation of one, or two, clonal identification laboratory, in Sembawa and/or in Sungei Putih, in order to provide further services to estates, or research.

### **Date :**

- Before April for the collections
- in september for the first level budwood garden of Sembawa

The most probable would be the second date.

### **Implementation :**

The mission is able to provide 400 analysis in 15 days (26 analysis per day, in average). We suggest the possible distribution of work, based on a mission to be implemented in september 1994 :

#### **- 1 - control of first level budwood garden**

- control of Sembawa first level budwood garden (to be created in january 1994) :
- 21 clones with 16 trees each, so 336 analysis : 15 % of the planted trees of the garden. (16 clones are coming from Sembawa collection and 5 clones from Sungei Putih collection)

**- 2 - Additional Analysis (from the experience of the previous mission of april 1992)**

Following the analysis from the previous mission made by Patricia Lebrun in April 1992 : we suggest a certain number of possible operations to be done in order to improve the clonal identification in the existing planting material in Sembawa and Sungei Putih:

- *The case of BPM 24* and a possible presence of 2 clones : control of BPM 24 budwood garden and BPM 24 in the collection, both in Sembawa and Sungei Putih, and possibly in North-Sumatra estates (Goodyear for instance....) in order to identify without any doubt this clone (there is possibly a mix-up of two clones for BPM 24, as identified in North-Sumatra estates). BPM 24 is a very promising clone, created by RRIL, and already widely used in experimentation (like Rubber Intercropping Project/STD III of Sembawa). The control of BPM 24 purity is of extremely importance. Number of BPM 24 analysis : 30 (Sembawa : 10, Sungei Putih : 10, for both station 5 in collection and 5 in multiplication budwood garden, and Goodyear : 10).

- *The case of RRIC 110* in Sembawa : control in the two collections of Sungei Putih and Sembawa of RRIC 101, and comparison with the one in the multiplication budwood garden in Sembawa, which is like the one identified in collection of Bimbresso in Côte d'Ivoire, but not identic to the one present in the Sembawa collection. Number of RRIC 110 analysis : 20 (Sungei Putih and Sembawa : 5 in collection and 5 in multiplication budwood gardens in each station).

- *The case of PR 107* : which is not well identified in Sembawa. Number of PR 107 analysis : 10 (5 in Sembawa, 5 in Sungei Putih).

- *The case of PR 261* : as used as the main control in the trials network ; it should be fully identified and certified (already accounted in Sembawa control). As PR 261 is different from AF 261 in Africa, it is recommended to put that clone in the suggested exchange of clones between CIRAD-CP and RRIL, in order to obtain information on performances of this clone under african conditions.

- 3 - Identification and genetic cartography (electrophoretic fingerprints) of some clones released by RRIL, and unknown in Africa, in order to increase our common knowledge (CIRAD and RRIL) of the genetic fingerprints of clones : like some clones from the PR 400 series, the TM series, some PB series as PB 314, PB 330, the BPM series : BPM 1, BPM 107....RRIM series as series 700 (RRIM 703, RRIM 712, RRIM 717...), series 800 (RRIM 805) and series 900 (17 analysis). A complete program of identification could be later developed by RRIL for further identification. This proposition may be discussed for agreement.

### **Conditions of implementation :**

Two teams from Sembawa and Sungei Putih may work together with the CIRAD scientist in order to give to him full support and to train to the electrophoresis technique. The two teams may be present both in Sembawa and Sungei putih :

- Sembawa : 336 analysis = ~~16~~ days + 1 day of theoretical training and methodology. Total in Sembawa : ~~17~~ days

- Sungei Putih : 52 analysis = ~~3~~ days

#### **Transfer**

- 1 day : arrival in jakarta.
- ~~2~~ day : transfer Jakarta/Palembang, and set up of the laboratory .
- ~~2~~ day : transfer Palembang/Medan and set up of the laboratory .
- 1 day : transfer Medan/Jakarta.
- 1 day in Jakarta for Mission report at IPARD.

**Total number of days required : ~~28~~ days.**

Sembawa team : Ibu Mudji + 1 technician.

Sungei Putih : 1 researcher + 1 technician.

Working time : as the analysis required almost full day time, it is suggested to modify exceptionally the working timetable as following : from 8 AM to 7 PM, including a lunch and rest time.

It is suggested to provide a good technician, who can be used as a translator from french/english to Bahasa Indonesia, in order to ensure perfect conditions for the implementation of the mission and the transfer of technology. It is suggested that Pak Siswanto, returned from France at that time, can be that person, due to his perfect knowledge of the french, and due to his capacities in term of laboratory experience.

### **Cost**

The mission in itself cost around 11 000 US \$ (~~23~~ millions Rp). The mission could be financed trough the multilocation clone trials network project for clonal recommendations (which will rely on external funding). A pre-financing or other possibilities has to be found. The cost of transportation and daily allowance for the two teams in Sembawa and Sungei Putih should be taken in charge by RRIL.

***Expected output***

- 1 - Control and certification of planting material for the trials.
- 2 - Transfer of technology of clone identification methodology using electrophoresis technique and training of two teams.



## CIRAD-CP

offers a portable electrophoresis laboratory for on-site analysis, however far away the plantation, using genetic marking molecular techniques.

“ DISTRIBUTION OF BUDWOOD THAT IS NOT PURE, OR OF POORLY IDENTIFIED CLONES, HAS TOO GREAT AN EFFECT ON THE FUTURE OF PLANTATIONS AND PROJECT PROFITABILITY TO BE OVERLOOKED OR NEGLECTED. ”



Enzymatic markers can be used to produce veritable "genetic fingerprints" for *Hevea* clones. This method has been in use for 10 years and provides an immediate and reliable answer for:

- IDENTIFYING the clones already planted,
- TESTING their purity before multiplying them,
- CHECKING batch purity in budwood gardens,
- CHECKING progeny legitimacy.



**ANEX 3**

***ESTABLISHMENT AND COST OF MULTIPLICATION BUDWOOD GARDENS***

### ANEX 3

#### **ESTABLISHMENT AND COST OF MULTIPLICATION BUDWOOD GARDENS**

The first level budwood garden of Sembawa will provide 10 trees per clones. The following table (Table 1) shows the number of budwood sticks expected per clone for the first year :

Table 1 Budwood sticks production of the first level budwood garden of Sembawa and expected bugrafted stump production of the multiplication garden.

ITEMS		Number of plants
112 trees	112 meters of budwood sticks	1120 buds
Bud grafting	70 % of success	784 trees
Effectively grown and selected in the field	80 % of success (elimination of poor planting material)	672 trees

#### ***The selected clones***

The 21 clones selected for the trials are already presented in the Table 2.

#### ***Area and location of the multiplication budwood gardens***

This will be discussed and decided later. The table 4 may give a first idea.

#### ***Cost of establishment***

The total cost of establishment of the multiplication budwood gardens can be roughly estimated from the complete trials network requirements. It is presented in table 5.

#### ***Date of implementation***

In order to gain time in the process of budwood production, and to increase the certified budwood availability to the required level for the trials, it is suggested to implement as

soon as possible the multiplication budwood gardens, depending on budwood sticks availability from first level budwood garden of Sembawa. The calendar could be the following :

Establishment of the rootstocks nursery :	January 1994
Budwood availability from first level budwood garden of Sembawa :	October 1994
Budgrafting :	October 1994
planting :	November 1994
Budwood sticks availability for trials planting :	October 1995

Tables of the annex 3 :

Table 4 : POSSIBLE LOCATIONS OF THE TRIALS AND OF THE MULTIPLICATION BUDWOOD GARDENS OF THE CLONE RECOMMENDATION TRIALS NETWORK

Table 5.1 : COST ESTIMATION PER HA : BUDWOOD GARDEN ESTABLISHMENT : YEAR 0.

Table 5.2 : COST ESTIMATION PER HA : BUDWOOD GARDEN ESTABLISHMENT : YEAR 1.

Table 5.3 : BUDWOOD GARDEN : COST PER METRE OF BUDWOOD STICK (5 years production basis)

Table 5.4 : MULTIPLICATION BUDWOOD GARDEN REQUIREMENT AND COST OF ESTABLISHMENT.

Table 4 POSSIBLE LOCATIONS OF THE TRIALS AND OF THE MULTIPLICATION BUDWOOD GARDENS OF THE CLONE RECOMMENDATION TRIALS NETWORK  
(First draft)

ISLAND	PROVINCE	LOCATION	PARTNER for implementation (Possibly)	KIND OF TRIAL	LOCATION OF THE BUDWOOD GARDENS
KALIMANTAN	WEST	Pontianak	PT rivaco Mandum TCSDP	CFT OFT	One for West Kalimantan
		Ketapang	Dinas Perkebunan PTP XIII	CFT	Could be based in PTP Pontianak
		Sintang		CFT BFT	
	CENTRAL	Pabgkalan bun	PTP XXVI	BFT	One for Central, South, and East Kalimantan Based in PTP.
	SOUTH	Danau Salak	PTP XVIII	BFT	
	EAST	Tanjung Santan	PTP XXVI	BFT	
SUMATRA	SOUTH	Baturaja	PTP III	BFT	One for South Sumatra, Jambi and Riau.  Based in Sembawa, Jambi and RIAU (PTP)
		TCSDP Prabumulih South Palembang	TCSDP Private	OFT CFT	
	JAMBI	Tanjung Jabung	Brahma Binabakti	BFT	One for Bengkulu and West Sumatra
	RIAU	unidentified	????	BFT	
	WEST (possibly)	????	???? (ICRAF)	BFT CFT	
	BENGKULU (possibly)	Muko-Muko	PT SIPEF	BFT CFT	
MOLLUCAS	CERAM (possibly)	????	???? (PTP)	BFT	One for Irian Jaya and Ceram
IRIAN JAYA	(possibly)	????	???? (TCSDP)	BFT	

TABLE 5.1

## COST ESTIMATE PER HA

## BUDWOOD GARDEN ESTABLISHMENT : UNIT COST, 1993

YEAR 0

ACTIVITIES	MANDAYS	MATERIALS TOOLS	UNIT	N° UNIT	UNIT COST	COST RP
B Labor		A 1 Materials	piece			
Land preparation	15	Linings pegs		10 000	3	30 000
Lining	15	fencing material	piece	10 000	400	4 000 000
Holing	200	planting material	HA	0	250 000	62 500
fertilizing	20	Guardhouse				
Planting/supplying	100	Total A1				4 342 500
Fencing, road, drainage	20					
Maintenance/Mulching	80	A 2 Pesticides	Lt	2	20 000	40 000
Pest & diseases control	5					
Pruning	2	A 3 Fertilizers				
watchman	45	RP	Kg			
Others	10	Urea	Kg	600	230	138 000
Total B Labor MANDAYS	512	TSP	Kg	1 500	290	435 000
		KCL	Kg	200	290	58 000
		Total A 3				631 000
Labor cost in Rp/day	2500					
		A 4 Tools				
		Small tools				100 000
		Sprayer	Ha	0	140 000	35 000
		Total A 4				135 000
		A 5 Land rental	Ha	1	250 000	250 000
		A 6 Others				
		Land clearing & preparation				204 750
		Wheel tractor	hours	20	20 000	400 000
		Total A 6				604 750
		Total A1+A2+A3+A4+A5+A6				6 003 250
TOTAL LABOR COST B	1 280 000	TOTAL COST A + B				7 283 250

Based on TCSDP data and adapted.

cost of 1 meter of  
budwood = 400 Rp

(TCSDP &amp; GAPKINDO prices)

Budwood garden with 8000 plants /ha.

Rock phosphate non available, replaced by TSP

Cost of land clearing : option bush (see table 1)

TABLE 5.2

## COST ESTIMATE PER HA

YEAR 1

## BUDWOOD GARDEN PRODUCTION : UNIT COST, 1993

ACTIVITIES		MANDAYS	MATERIALS TOOLS	UNIT
B Labor			A 1 Materials	
Fence, road , drainage maintenance		5	Herbicide Lalang Tar/parafin	Lt
Weeding/mulching		60	Total A 1	
fertilizing		10	A 2 Pesticides	Lt
Pest and diseases control		5		
Pruning		70	A 3 Fertilizers	
Transport preparation		50	RP	Kg
Transport		12	Urea	Kg
watchman		90	TSP	Kg
Others		8	KCL	Kg
			Dolomite	Kg
Total B Labor		310	Total A 3	
Labor cost	2500		A 4 Tools Small tools	
			A 5 Land rental	Ha
			A 6 Others	
			Transport	KM
			Total A1+A2+A3+A4+A5+A6	
TOTAL LABOR COST		775000	TOTAL COST A + B	

Based on TCSDP data and adapted.  
Budwood garden with 8000 plants /ha.

TABLE 5.3

## BUDWOOD GARDEN : COST PER METRE

Constant price

YEAR	COST/HA	PRODUCTION METER/HA	COST/METRE (Rp)	AVERAGE PRICE /M
Y0	7 283 250			
Y1	1 851 750	7 200	1 269	
Y2	1 851 750	14 400	509	
Y3	1 851 750	21 600	254	
Y4	1 851 750	21 600	170	
Y5	1 851 750	21 600	127	
Total	16 542 000	86 400	191	
Average cost on 5 years *			191	

Based on TCSDP data and adapted.

Cost year 1 to 5 = cost year 1

\* Including year 0

Cost price for a certified meter of budwood garden (5 years basis):	191 Rp
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TABLE 5.4

**BUDWOOD GARDEN REQUIREMENT**

	YEAR		
	1995	1996	1997
Total area of budwood gardens required in Ha :	0,866	4,781	3,98

**COST OF ESTABLISHMENT OF MULTIPLICATION BUDWOOD GARDENS**

COST OF ESTABLISHMENT YEAR 0		Rp
YEAR 1		7 283 250
TOTAL COST for 1 hectare		1 851 750
		9 135 000
COST PER YEAR	Number of hectare	
1994	0,866	7 910 910
1995	3,915	35 763 525
Budwood sticks shipping NOT INCLUDED		

Cost based on TCSDP data , adapted.

The cost of year 1994 should be held by BPS

The cost of year 1995 should be held by the Donor.