


TECHNICAL COOPERATION FOR  
THE TRIAL PLANTATION PROJECT  
IN BENAKAT, SOUTH SUMATRA  
(ATA-186)

TECHNICAL REPORT

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MARCH, 1988  
JAPAN INTERNATIONAL COOPERATION AGENCY  
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Technical cooperation for the trial plantation project in Benakat, South Sumatra (ATA-186)

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TECHNICAL REPORT

1. UP TO AUGUST 30 th 1982
2. 1982/ 1983
3. 1983/ 1984
4. 1984/ 1985
5. 1985/ 1986
6. 1986/ 1987

TECHNICAL COOPERATION FOR  
THE TRIAL PLANTATION PROJECT  
BENAKAT , SOUTH SUMATRA

TECHNICAL PROGRESS REPORT  
( UP TO AUGUST 30<sup>th</sup> , 1982 )

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DIRECTORATE GENERAL OF FORESTRY  
DIRECTORATE OF REFORESTATION AND  
LAND REHABILITATION.

SEPTEMBER , 1982 .

## Preface

This Technical Report is the result of implementation of the Trial Plantation Project ( ATA - 186 ) in 1981/1982 and 1982/1983 plan of operation. As reported to the 4<sup>th</sup> Joint Steering Group meeting held in Jakarta, January 1982, some activities such as plantation, and construction of facilities has not finished yet. However, by the end of March 1982 plantation has done it's target completely.

The Technical Report submitted for the 5<sup>th</sup> Joint Steering Group meeting here in, consist of technical progress and budget expenditure of the TPP ( ATA - 186 ) during the year of 1981 / 1982 and 1982 / 1983 up to August 1982. This report is expected to be a source of consideration for implementing the project in the following years, and to evaluate the past activities.

Palembang, August 1982

Field Manager,

( Zulkifli Mulsani )

## I. Operational Activity.

### A. Operational and Finance Target.

In 1981/1982 the Government of Indonesia has been allocated some Rp. 269.306.000,- for implementation of nursery, plantation, forest road construction and administration. For detail please refered to the following table :

Table 1. Budget prepared for 1981/1982 activities.

No.	Item	Unit	Target	Expense (x Rp.1.000,-)
1.	Establishment of nursery and plantation			
	a. Nursery	ha	1,6	10.100,-
	b. Plantation	ha	400	60.000,-
	c. Forest Road	km	8	15.780,-
	d. Fire Belt	km	10	3.925,-
	e. Infra - structure	m <sup>2</sup>	530	51.875,-
2.	Administration	-	-	127.625,-
<b>Total.</b>				<b>269.306,-</b>

Furthermore, to carried out the activities of the year 1982/1983, some Rp. 367.138.340,- has been allocated which comes from two sources, first through DIP. 1982/1983 of Rp. 242.997.000,- and second through Inpres 6/1982 of Rp. 124.141.340,-

Detail description of budget allocation appears in the following table.

Table. 2. Budget prepared for 1982/1983 activities through DIP.

No.	Item	Unit	Target	Expense (x Rp.1.000,-)
1.	Developing technics of nursery & plantation			
	a. Observation and evaluation of seedlings, trees and forest protection.	-	-	5.100,-
	b. Maintenance of forest road.	km	11,5	7.905,-
	c. Study of ecology.	-	-	2.250,-
	d. Agroforestry.	ha	70	10.525,-
	e. Facilities .	m <sup>2</sup>	610	38.690,-
2.	Administration .	-	-	178.527,-
	Total budget	-	-	242.997,-



Table. 3. Budget prepared for 1982/1983 activities through Inpres 6/1982.

No.	Item	Unit	Target	Expense (x Rp.1.000,-)
1.	Establishment of mechanize plantation.	ha	330	37.806,-
2.	Establishment of manual plantation.	ha	300	15.225,-
3.	1 <sup>st</sup> year Tending of plantation.	ha	200	3.700,-
4.	2 <sup>nd</sup> year Tending of plantation.	ha	200	7.060,-
5.	Construction of forest-road & working house.	km unit	12 4	33.708,-
6.	Establishment of nursery.	seedlings	1.640.000.	16.117,10
7.	Establishment of firebelt.	ha	32	8.970,-
8.	1 <sup>st</sup> year Tending of fire belt.	ha	20	1.174,-
9.	2 <sup>nd</sup> year Tending of fire belt.	ha	10,8	381,24
Total budget				124.141,34

## 8. Operational and Finance Progress.

### 1. Operational and Finance progress of 1981/1982.

Progress report of the 1981/1982 plantation activities has been made for the 4<sup>th</sup> joint steering group meeting on January 1982. Therefore, following reports are the continuation of those .

#### 1.a. Operational progress.

##### a.1. Nursery.

Nursery activities covered by the 1981/1982 budget are merely for constructions of facilities, such as cutting shed, germination shed, growing bed and germination box. In the report prepared for the 4<sup>th</sup> Joint Steering Group meeting have been stated that 95 % of the target has been realized . To the end of August 1982 , those activities have been completely finished , as shown in the following table.

Table. 4. Realization of nursery facilities.

No.	Items	Target	Realization	Percentage
1.	Cutting shed	50 m <sup>2</sup>	50 m <sup>2</sup>	100
2.	Germination shed	5 sheds	5 sheds	100
3.	Growing bed	400 beds	400 beds	100
4.	Germination box	200 boxes	200 boxes	100

a.2. Plantation .

Plantation activities has finished the annual planting target of 12 tree species, comprises of 4 species for manual compartment, 3 species for mechanize compartment and species for introduction tets compartment. To the end of March 1982, those 12 species have been planted. Progress report of this work appears in the table bellow.

Table. 5. Operational progress of plantation work up to March 1982.

No.	Compartment	Species	Target ( ha )	Realization ( ha )	Percentage ( % )
1.	II. A - 5	<u>A. cadamba</u>	50	50	100
2.	II. A - 6	<u>S. bancana</u>	50	50	100
3.	II. A - 7	<u>P. canescens</u>	50	50	100
4.	II. A - 8	<u>A. auriculiformis</u>	50	50	100
5.	II. B - 1	<u>E. deolupta</u>	50	50	100
6.	II. B - 2	<u>A. falcata</u>	50	50	100
7.	II. B - 3	<u>P. merkusii</u>	50	50	100
8.	II. C - 1	<u>E. cyclocarpum</u> <u>L. leucocephala</u> <u>P. indicus</u> <u>A. molluccana</u> <u>A. mangium</u>	50	50	100

In order to evaluate survival percentage of the planted seedlings, one month after planting evaluation was made . The result is shown in the table below .

Table. 6. Survival percentage of planted trees at one month after planting .

No.	Species	Area (ha)	Survival (%)
<b>1. Manual Compartment</b>			
a.	<i>A. auriculiformis</i>	50	88,13
b.	<i>A. cadamba</i>	50	91,51
c.	<i>P. canescens</i>	50	74,34
d.	<i>S. bancana</i>	50	83,25
<b>2. Mechanize compartment</b>			
a.	<i>E. deglupta</i>	50	73,10
b.	<i>A. falcata</i>	50	95,00
c.	<i>P. merkusii</i>	50	91,90
<b>3. Introduction species</b>			
a.	<i>A. moluccana</i>	6	95,10
b.	<i>A. mangium</i>	6	90,53
c.	<i>E. cyclocarpum</i>	10	99,27
d.	<i>L. leucocephala</i>	13	98,77
e.	<i>P. indicus</i>	15	98,75

Second evaluation is due to made on September - Oktober to know the effect of droughtness to the growth of trees .

In August 1982 , 2 species has found damaged by pests namely *A. falcata* was by deers and *A. cadamba* was rodented by rst.

### 2.3. Forest Road .

Construction of the 8 km forest road was accomplished 1981, and has reported to the 4<sup>th</sup> Joint Steering Group meeting held in January , 1982.

### 2.4. Forest Protection .

In 1981/1982 fiscal year , two kinds of fire belt have been established , namely green fire belt and yellow fire belt . Realization of the annual target is shown in the following table .

Table. 7 . Realization of establishing fire belt .

No.	Species	Target	Realization	Percentage ( % )
1.	A. cadamba	0,2 km	0,2 km	100
2.	S. bancana	0,5 km	0,5 km	100
3.	A. mangium	0,5 km	0,5 km	100
4.	C. mucunoides (cover crop)	1,35 km	1,35 km	100
5.	S. macrophylla	2,75 km	2,75 km	100
6.	Yellow fire belt	4,5 km	4,5 km	100

a.5. Construction of Project Facilities .

In the 1981/1982 fiscal year , the Government of Indonesia allocated some budget to build 4 buildings ( mess, labour house, laboratory and ware house) , 2 unit fire control, 1 unit water instalation, 1 unit electrical instalation and to purchase , 3 unit veear cars .

To the end of January 1982 , 3 unit year car have purchased, 1 unit water instalation and 2 unit fire tower control have construted and the remain 4 building are still under construc - tion ( nearly 50% ) .

Based on the realization of nursery , plantation , forest road , forest protection and general administration , up to the end of August 1982 the project has realized 75,83 % of its target . Detail of the progress is given below .

Table. 8. Project implementation progress by the end of August 1982.

No.	Item	Annual target		Traget up to		Realization up to	
		Expeence (xRp1.000.)	Weight (%)	this month unit (%)	Balance (%)	to this month Unit (%)	Balance (%)
1.	Establishment of nursery , plantation , forest road , fire belt and others.	141.681	52,61	100	52,61	100	52,61
2.	General adminis- tration.	127.625	47,39	100	47,39	49	23,22
T o t a l		269.306	100	-	100	-	75,83

1.b. Finance expenditure of 1981/1982 fiscal year .

Implementation of the Trial Plantation Project up to August 1982 had spend a total Rp.203.929.996,12 or 75,7 % of the total budget.

Table. 9. Finance expenditure up to August 1982.

No.	ITEMS	Budget	Expenditure		Remain budget	
		(xRp1.000,-)	Rp.	%	Rp.	%
1.	Establishment technics of nursery and plantation.	<u>141.681</u>				
a.	Nursery	10.100	9.417.476,25	93,24	682.573,75	6,76
b.	Plantation	60.001	47.202.589	78,67	12.798.411.	21,33
c.	Forest road	15.780	15.611.675	98,93	168.325.	1,17
d.	Fire belt	3,925	3.787.650	96,50	137.350	3,50
e.	Facilities	51.875	15.213.382,50	29,23	36.661.617,50	70,77
2.	Administra- tion .	<u>127.625</u>	112.697.223,37	88,30	14.927.776,63	11,70
<b>T o t a l</b>		269.306	203.929.996,12	75,73	65.376.003,88	24,27

2. Operational Progress of 1982/1983 budget through  
Inpres 6/1982.

2.a. Operational realization.

a.1. Nursery .

In 1982/1983 activities nursery had planned to raise up 1.640.000. seedling consist of 28 species. Some of them are : Dalbergia latifolia , Casuarina equisetifolia , Koompassia malacensis , Pinus caribaea , Cryptomeria japonica , Chamaecyparis obtusa , Samanea saman , Shorea leprosula and other species which was planted last year , Up to the end of August , nursery works has come to 54 % of its target . Progress of nursery works are describe below :

Table. 10. Progress of nursery works up to August 1982.

No.	Target	Realization	Percentage
1. Land preparation	3,5 ha	3,5 ha	100
2. Collecting soil media			
- Top soil	190 m <sup>3</sup>	152 m <sup>3</sup>	90
- Sand	55 m <sup>3</sup>	55 m <sup>3</sup>	100
- Compost	30 m <sup>3</sup>	24 m <sup>3</sup>	90
3. Germinating seeds	200 kg	115 kg	52
4. Pot filling	1.640.000 pots	1.123.600	68
5. Pricking-out	1.640.000 seedling	400.500	24
6. Tending	1.640.000 seedling	400.500	24



a.2. Plantation .

Plantation has started its works since April 1982 with land preparation ( blocking compartment ) , of 630 ha. Site preparation namely land clearing and soil cultivation of mechanize compartment has started on July 1982 .

Total area for mechanize plantation is 330 ha . The remaining 300 ha is for manual plantation , and site preparation is due to start on Oktober 1982. Therefore, operational progress of plantation reflected mainly by site preparation of mechanize compartment and has come to 19,5 % of its annual target .

Detail of plantation activities are described below .

Table. 11. Target and realization of plantation works of 1982/1983 up to August 1982 .

No.	Activities	Target	Realization	Percentage
<b>A. Mechanize plantation</b>				
<b>1. Land preparation</b>				
	a. Blocking of compartment.	330 ha	330 ha	100
	b. Plantation nama board.	24 pieces	-	-
	c. Construction of working shed.	12 unit	-	-
<b>2. Site preparation</b>				
	a. Land clearing	330 ha	160 ha	48,5
	b. Ploughing I & II	660 ha	147 ha	22,1
	c. Harrowing	330 ha	-	-
<b>3. ....</b>				

3. Planting	495.000 seedlings	-	-
4. Tending	-	-	-
8. Manual plantation			
1. Land preparation			
a. Blocking of compartment	300 ha	300 ha	100
b. Construction of working shed	12 unit	-	-
c. Strip clearing	300 ha	-	-
d. Plant hole digging	300 ha	-	-
2. Plantation	450.000 seedlings	-	-
3. Tending	300 ha	-	-

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Progress of plantation works especially of mechanize plantation is a bit late , because the equipment available are not sufficient . Additional machanis & equipments provided by the Government of Japan has been arrived in Palembang harbour since July 1982 . Among then are Angle dozer and Wheel tractor , which necessary for site preparation . To withdraw those equipments is now under process to get the permission letter from Secretary Cabinet.

a.3. Construction of forest road .

In 1982/1983 forest road has to construct 12 km road , comprise 4 km main road and 8 km working road . To the end of August 1982 60 % of its annual target has been realized. Remaining works such as graveling , and leveling will be finished soon . The problem of construction of forest road is caused by delay of budget which comes through Inpres 6/'82.

Approval by Government of South Sumatra for Inpres 6/1982 budget realized on August 1982 . For further detail referred to the following table .

Table. 12. Target and realization of construction of Forest road .

No.	Items	Target	Realization	Percentage
1.	Design & Survey	12 km	12 km	100
2.	Land clearing	12 km	12 km	100
3.	Construction of road profile	12 km	12 km	100
4.	Material			
	- Sand	70 m <sup>3</sup>	32 m <sup>3</sup>	} 4,5
	- red brick	15.000 pieces	3.000 pieces	
	- Cement	150 bags	30 bags	
	- concrete pipe	20 pieces	6 pieces	
	- gravel	500 m <sup>3</sup>	-	
	- lumber	5 m <sup>3</sup>	-	
5.	Construction of concrete drainage	3 pieces	1 pieces	33
6.	Leveling road profile	12 km	6 km	50
7.	Construction of ditch	24 km	12 km	30
8.	Graveling / road pavement	4 km	-	-
9.	Name board and traffic signs	-	-	-

a.4. Forest Protection .

Forest protection section planned to establish 32 ha ---

fire belt , a fire control group and to make some warning name board of fire dangerous .

To the end of August 1982, 25 % of its annual target has been realized , as shown in the following table .

Table. 13. Target and realization of protection works .

No.	Items	Target	Realization	Percentage
1.	Designing	32 ha	24,45 ha	76,41
2.	Land preparation	32 ha	9,60 ha	30
3.	Site preparation			
	a. Land clearing	32 ha	8,16	25,50
	b. Ploughing I	32 ha	5,06	15,81
	c. Ploughing II	32 ha	-	-
	d. Harrowing	32 ha	-	-
4.	Planting	32 ha	-	-
5.	Tending	32 ha	-	-

Based on the realization of nursery , plantation , fire belt and road construction works , the project has reach 34,6 % of its target by the end of August 1982.

3. Operational progress of 1982/1983 budget through DIP. 1982/1983.

Activities which costed by the DIP. 1982/1983 are :

- a. Observation and evaluation of seedlings , trees and forest forest protection , for
- b. Maintenance of forest road.
- c. Study of ecology .
- d. Agroforestry .
- e. Construction pf facilities .
- f. Administration .

3.a. Observation and evaluation in nursery , plantation and forest protection .

This activities aim to carry out study and developing technics of nursery , plantation and forest protection in small scale , Study and observation has made in forest protection through observation of pest and disease, establishing a group of fire control and instal some warning sign board . Operational realization has reached only 17 % .

3.b. Maintenance of forest road .

Maintenance of forest road as long as 11,5 km has reached 27 % of its annual target . This work consist of rehabilitation , construction of concrete pipe drainage and bridges .

3.c. Study of ecology .

Study of ecology consist of species composition survey, biomass survey and soil survey , This work could not run smoothly because some important equipments such as for soil analysis , oven , and others equipments have not available yet . Of the annual target , study of ecology has realized - 50 % ,

mainly of biomass survey and soil survey (physical properties).

3.d. Agroforestry .

As stated in the plan of Agro-forestry , the Government of Indonesia allocated some budget for construction of 30 living houses for the farmer , and for plantation of 70 ha are. By the end of August 1982 , 20 % of its annual target has been realized . Construction of infrastructure such as road , building , demonstration area , forest model , tower , bridge, water instalation and soil preparation are now under construction . Those works are beared by Japanese Government .

3.e. Construction of facilities .

In 1982/1983 budget the project will construct 3 unit living houses , and seeds drying floor of 400 m<sup>2</sup> . The Construction has not started yet because a new regulation is going to be issued by the National Development Planning Board and the Ministry of Finance . Another facilities beared by 1982/1983 budget is to purchase 2 unit of disc plow and maintenance of the buildings; By the end of August 1982 , 17 % of its annual target has realized .

3.f. Administration .

Administration works involved general expenditure has reached 27 % of its target .

From the above description , through the DIP. 1982 / 1983 the Project has realized 24,08 % of its annual target as shown in the following target .

Table. 14. Target operational progress and expenditure of 1982 / 1983 budget up to August 1982,-

No.	Items	Budget	Target up to this month		Realization up to this month	
			Unit (%)	Expense (xRp1.000.)	Unit (%)	Expense (xRp.1.000,-)
1.	Developing technica of nursery & planta tion .					
	a. Observation of seedlings, trees and forest pro tection .	5.100	37	1.230	17	368,20
	b. Maintenance of road .	7.905	56	4.500	27	1.971,20
	c. Study of ecology	2.250	44	1.000	25	-
	d. Agroforestry	10.525	57	6.000	2	105
	e. Construction of facilities .	38.690	64	24.950	17	6.900.
2.	Administration .	128.527	43	76.646	27	48.252,40
<b>T O T A L</b>		<b>242.997</b>	<b>47</b>	<b>114.961</b>	<b>24,08</b>	<b>57.771,80</b>

## II. Problems and Solution.

1. About 28 species has to raised up in 1982/1983 nursery works. Consequently seeds supply appear to be problems. Some species can easily obtained, but others species such as Gmelina arborea, Cryptomeria japonica, Chamaecyparis obtusa, Shorea sp, Acacia mangium and Schima bancana are not sufficient. To cope with this problems some species were propagated by vegetative organ, namely by cutting. For future activities, the Sub Directorate of Plant Material is expected to solve the problem together with the project.
2. Past experiences shows that soil preparation in mechanize compartments need sufficient equipments in order to cultivate soil at the right time which means during the dry season. In fact, some additional equipments necessary for plantation works such as crawler tractor (angle dozer) and wheel tractor have just arrived in Palembang harbour in July 1982. Letter of permission issued by Secretary of Cabinet is now under taking to withdraw the equipments from the harbour.
3. In 1982 / 1983 project activities has two sources of budget. For operational works such as nursery, plantation, forest protection (fire belt), and road construction the budget are beared by the budget comes through DIP 1982 / 1983. To spend the Inpres budget, approval by Governor of South Sumatra is necessary. But because of some unknown reason, the approval has just issued on mid of August



1982, and after took some administration procedures the Inpres budget can be used in early September 1982. So far, however, budget problems can solved by borrow the money from Regional Forest Offices some Rp. 15.000.000,- , so that implementation of some activities were not completely delayed.

4. In a remote area like Benakat, cost of fuel become very expensive compare to the current price.

Transportation cost for 1 tanker ( 4.000 l ) worth Rp. 150.000,- for diesel fuel and Rp. 200.000,- for gasoline. Monthly consumption of diesel fuel is 16.000 l and 4.000 l for gasoline. Therefore for transportation of fuel, project has to spend Rp. 800.000,- per month or Rp. 9.000.000,- a year. From the above calculation it is feasible to provide 1 tanker truck so as to reduce cost of fuel.

TECHNICAL COOPERATION FOR  
THE TRIAL PLANTATION PROJECT  
BENAKAT, SOUTH SUMATRA  
ATA - 186

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TECHNIQUE REPORT

1982 / 1983

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DIRECTORATE GENERAL OF FORESTRY  
DIRECTORATE OF REFORESTATION AND LAND  
REHABILITATION.

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## TECHNIQUE REPORT

As we know, the aim of this project is to find the true species, technique and management of Afforestation in a large scale on Alang-alang area.

This technical report gives a short figure about the above mentioned object.

### 1. Nurseries

#### 1.1. Seedling quality.

This year the seedling quality is found to be better than in the last 2 years, particularly for pinus.

This was maybe caused by the natural infection by Micorrhiza on the nurseries, beside the improvement of the soil structures in every tubes.

#### 1.2. Nursery technique

##### 1. Sowing media.

After having some experience, the media supposed to be the best is fine sand. To prevent the disease the sand first to be washed with the detergents, and then dried up to 100<sup>o</sup> C.

##### 2. Composition of plant media on the tube.

Based on the last experience the best composition of plant media to be mixture of ordinary soil, sand and compos with the portion 7 : 2 : 1 respectively.

### 3. Seedling bed.

There are 3 kind of seedling beds being used, i.e. ;  
wooden - frame - bed, wired - frame - bed, and red -  
bricked - bed.

The last type to be the best.

### 4. Watering system

The are 2 kind of watering system being applied i.e.  
sprinkle and plastic - pipe sprayer. The last type to  
be the best.

### 5. Shading

The are some kinds of shading types being used. The best  
type is using sarlon - cloth.

### 6. Planting box.

There are 2 kinds of planting box being used, that is made  
of wood and the other from coca-cola container. The last  
to be better.

### 7. Disease control

To prevent the diseases all seedling to be sprayed using  
fungicides every 2 weeks.

### 8. Fertilizing

Fertilizer is given only as basic fertilizer to be mixed  
on soil seedling media.

## 2. Manual planting

2.1. Several techniques in making planting - line was already done, i.e. by cutting using hand - tools, using brush - cutter, spraying using herbicides. And the combination between cutting and spraying, before planting period.

The better techniques is by cutting, as for the last technique is being tried.

2.2. The size of planting hold on along - along area is being accessed.

### 3. Land-clearing on mechanical method.

Two method of land clearing is being applied i.e. direct slashing by bulldozer and the other is burning before slashing.

For the last year, burning system will be applied in the restricted area, due to the high cost needed for fire - break construction, and labour payment for fire control for the bulldozer operator this method is disliked because so much ash entering the machine.

### 4. Soil tillage

In the phase experiment several treatments on soil tillage are such as follows.

1. Total tillage 1 time plough
2. Total tillage 1 time plough + 1 time harrow
3. Total tillage 2 times plough + 1 time harrow
4. Strip tillage 1 time + 1 time harrow
5. Strip tillage 2 times + 1 time harrow.

The result of these experiments is primarily such as follows :

1. The growth - rate of plantation (A.mangium) on all treatment are the same.
2. The density of alang - alang ( stems per hectare) on treatment 2 and 3 are the same.
3. The density of alang - alang on treatment 1 is 3 fourth more than treatment 3.

But within the next 6 months the density to be the same.

The above data shows that the best soil tillage intensity is total land clearing, unnecessary total tillage, i.e. strip tillage with 1 time plough and 1 time harrow.

4. The density of alang - alang on soil ploughed during the dry season is more less than on soil ploughed during rainy season. So to eliminate the alang - alang the best ploughing to be done on the dry season.

#### 5. Weeding

5.1. Weeding is one of the main problem facing this project.

The growth of alang - alang on the manual - clearing method is averagely 10 cm a week, so it is needed to clear the planting - line every 2 months up to the second year.

To day clearing intensity is done only 3 time per year.

5.2. The mechanical soil tillage only reduced the regrowth of alang - alang for 6 months. And afterward. The intensity

of weeding to be same as in manual one.

5.3. The experiment using herbicides shows that the regrowth of alang - alang to be reduced up to 5 months.

5.4. Pinus species, albizzia and puspa are likely to be more tolerant to weed competition, while mahoni and acasia are less tolerant and eucalyptus is intolerant.

5.5. In general, the growth of plantation on tumpangsari system is 3 times faster than in other systems, due to intensive weeding.

## 6. Fertilizing

Fertilizing is not yet much done. It seems that fertiling will give the significant result if combined with intensive weeding.

## 7. Survival percentage.

The survival percentage is general good, except compartment of pine and eucalyptus planten on 1980/1981. The survival aging 3 months reach 90 - 95 % and on the second year reaches 70 - 95 %, in average.

## 8. Fire control

Plantation have been surrounding by the forest roads which can be used as the fire belt.

The existing road intensity has already reached up to 25 m/ha, so every 10 - 25 ha area is surrounded by forest roads.



8.2. On the outterside of the plantation area, which close to fire source, have been built an enternal fire belt, which to be cleare every dry season.

8.3. The existing secondary forest along the river side on the project are is not disturbed for fire break.

8.4. Besides using the above mentioned types of fire belt, as an experiment have already used artificial green fire break i.e. Mangium, Mahoni, Jabon, cover crop etc, but it seems to be un-effective because the alang - alang still grow density underneath.

#### 9. Pest and disease control

Until now pest and disease are still not emerge seriously.

In general pest and disease emerge on the planting having the age between 5 - 7 years. The pest and disease that have monitored i.e. shut borer on mahoni, root-rot on Mahoni and stem borer on Albizzia having big size.

#### 10. Forest road

10.1. The existing road intensity up to 25 m/ha or 33 km on area of 1.300 Ha.

10.1. The roads on this project are not hardened due to the lack of stones. It was ever tried to use sand of 20 cm - thick, also, but both system did not give best rest result.

10.1. The suitable road construction on this area seems to be better than soil road as already used by PT. STANVAC.

The main problem of this type of soil road is the maintenance where the main road needs to be graded every month. And the branch road every 3 months.

#### 11. Agroforestry.

11.1. This year the crop production of the farmer is under normal because of long dry season and wild pigs.

11.2. It seems that every farmer needs cash money as much as Rp.50.000,- per ha to buy seeds for crop. They expect this money to be provided by the project. For this it is advised that soil tillage to be only done 1 time, and the rest expense for second ploughing and 1<sup>st</sup> and 2<sup>nd</sup> harrowing to be given to the farmer. So, they can get the money as much as Rp.70.000,- per hectare.

11.3. Some counterparts tried to cultivate the peanuts, maize and so on, but they underwent as much as Rp.50.000,- - Rp.5000. deficit.

#### 12. Promoting the suitable technique in Benakat.

Based on data and information collected until today, it is supposed that the suitable techniques in the future would be :

12.1. On the little steep area to be used manual method such as follows :

1. Planting line 2 m wide
2. The size of planting hold 50 x 50 x 30 cm
3. Planting to be sprayed with herbicides to reduced the regrowth of alang - alang for 6 months.
4. Planting
5. After 6 months weeding to be done 3 times every 2 months and then continue by weeding 2 times every 3 months up to the plant reach the 2 years age.

12.2. On the certain area we can use tumpangsari system such as follows:

1. Total land clearing
2. Total ploughing 1 time
3. The ploughed land then to be given the farmer
4. The expense will be the same as in mechanical method.

TECHNICAL COOPERATION FOR  
THE TRIAL PLANTATION PROJECT  
BENAKAT, SOUTH SUMATERA  
(ATA-186)

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TECHNICAL REPORT  
1983 / 1984

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MINISTRY OF FORESTRY  
DIRECTORATE GENERAL OF REFORESTATION AND LAND REHABILITATION  
DIRECTORATE OF REFORESTATION  
APRIL, 1984.

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## I. Plantation programme

A number of study and observation have been made in the recent years in order to develop a certain method of planting and to observe the initial growth of a number of species. The highlight of the study are summarized as follows :

### 1. Effect of cultivation intensity to the growth of Acacia mangium.

The common cultivation intensity which has been applied in reforestation programme is 2 times ploughing and 1 time harrowing. This method is adopted from rubber plantation or other crops estate. Since the final product and the tree growth are different from crops estate product, it would be possible to modified the cultivation method.

There are several treatment being tested, viz. :

- a. Total cultivation
  - a.1. 2 ploughs and 1 harrow.
  - a.2. 2 ploughs.
  - a.3. 1 plough and 1 harrow.
  - a.4. 1 plough.
- b. Strip cultivation.
  - b.1. 2 ploughs and 1 harrow.
  - b.2. 2 ploughs.
  - b.3. 1 plough and harrow.

The following table describe the preliminary result.

Table 1. Survival rate and tree growth of various soil cultivation.

Intensity	Total cultivation			Strip cultivation		
	Height (cm)	DBH (cm)	Survival (%)	Height (cm)	DBH (cm)	Survival (%)
a. 2 plgs + 1 harrow	346,90	2,18	97,25	295,98	1,73	98,65
b. 1 plg + 1 harrow	287,57	1,71	100	315,00	2,17	99,12
c. 2 plgs	302,43	1,82	98,14	306,54	1,73	99,35
d. 1 plg	243,58	1,28	97,38	-	-	-

As regard the hight and diameter growth, the two treatment shows different respons. It is clear, however, that tree growth at good soil texture is better than those at relatively adverse condition. Therefore, judging by those result modification of cultivation technics could be justified. For the current operational programme the procedures mentioned above have been applied.

## 2. Pre-treatment before planting.

When the seedlings are set out from nursery, they will abruptly leave the favourable environment in the nursery and have to grow under a hard condition in the field. In order to promote adaptability of seedlings to the new environment it would be necessary to treat properly. A very simple treatment is to remain them in nursery after having selected for a certain days, until they recover the vigor. This treatment have successfully reduced mortality during transportation and even after planting.

## 3. Land clearing method.

Originally, a new method of mechanical land clearing will be introduced. The method using a shredder machine is able to cut and

chop a tree up to diameter 10 cm. However, big trees still exist since the topography of plantation site is relatively steep and many this machine can not be operated. Land clearing on mechanical site at present still using bulldozers.

## II. Agro-forestry

1. From the view point of economic aspect, agro-forestry has been contributed relatively high value of income to the participants (farmers). A study on sosio-economic aspect of the farmers has been carried out to collect data concerning income, monthly expenditure, consumption patern and others. In 1982/1983 agro-forestry contribute only 42 % of the annual budget of the farmers. The remain 58 % were gained from various activities apart from agro-forestry scheme. This proportion is expected to be changed in 1985/1984 for the favour of agro-forestry scheme.
2. Paddy is still dominant crops in agro-forestry. In 1982/1983 average land occupied by paddy per family only 0,603 ha, whereas in 1985/1984 increase up to 0,882 ha per family. This trend is understandable since rice is staple food. Besides, the farmer can not afford to buy the seeds of other crops such as peanuts, sweet potato etc.

## III. Nursery

1. Effect of "Biofertil as Soil Activator".

Young seedlings of *Albizzia falcataria*, *Acacia mangium* and *Sesamea saman* were grown on the plastic pots. These pots were filled with sub-surface soils of Red-yellow podsolic soil, contained 0 g.



1 g or 2 g of "Biofertil/pot".

Effect of Biofertil could be seen, even 1 g of Biofertil/pot, it was considered that about 3 months growth seedlings were available for planting. On the other hand, comparing with "Biofertil" had much roots than poly nutrient fertilizer.

## 2. On the survival ratio of bare root seedlings.

From October to November 1982, young 5 species seedlings shown under below were transported into nursery beds and grown up until late March 1983. These grown up seedlings were planted in the plantation site, survival ratio of these seedlings were investigated, following table was gotten. From this table, possibility of planting *Swietenia macrophylla*, *Pterocarpus indicus* and *Gmelina arborea* without pot was shown.

Survival ratio at 3 months after planted

Species	Ratio %
- <i>Melaleuca leucadendron</i>	1,22 %
- <i>Swietenia macrophylla</i>	98,80 %
- <i>Pterocarpus indicus</i>	90,20 %
- <i>Albizia falcataria</i>	0,86
- <i>Gmelina arborea</i>	90,90 %

## 3. Seedling experiment of rattan

Seedling experiment of rattan has been accomplished in nursery section. The seed originally from South Sumatera natural forest and consist of 2 species, e.g. Manau and Sega.

The mixture ratio of top soil, sand and compost is 7 ; 2 ; 1 . The plastic pot medium has been in diameter and 15 cm height.

Seven months after sowing, the root of seedlings can broke plastic plot. Therefore seedling remove to bigger plastic pot which has 10 cm diameter and 20 cm height.

In the future, this experiment to be continued in the plantation area.

TECHNICAL COOPERATION  
THE TRIAL PLANTATION PROJECT  
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TECHNICAL REPORT  
OF TRIAL PLANTATION PROJECT  
BENAKAT, SOUTH SUMATERA  
1984 / 1985

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MINISTRY OF FORESTRY  
DIRECTORATE GENERAL OF REFORESTATION AND LAND REHABILITATION  
DIRECTORATE OF REFORESTATION

TECHNICAL COOPERATION  
THE TRIAL PLANTATION PROJECT ( ATA-186 )  
BENAKAT, SOUTH SUMATERA

Project tittle : The Trial Plantation Project  
in Benakat, South Sumatera (Extension)

Record of discussion : April 12, 1979

Addendum Record of Discussion : March 24, 1984

L o c a t i o n : Benakat, South Sumatera

Period of Extension : 2 (two) years, beginning on April 1,  
1984

I n s t i t u t i o n : Directorate General of Reforestation  
and Land Rehabilitation, Directorate  
of Reforestation.

Working Plan : Mechanized Plantation : 170 has  
Agroforestry Scheme : 30 has  
200 has

Budget for Operational Works : Rp. 329,031,000

Budget for Equipments : ₺

Jakarta, April, 1985

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## TECHNICAL REPORT

A number of studies and observations have been made in the 1984/1985 fiscal year. During that fiscal year, the Project has established 10 titles of studies and observations. Some of them are completely finished at the end of February, 1985.

### I. NURSERY

1. Trial on two kinds of pot medium for 5 species. Top soil as a pot medium has some disadvantages, due to some problems such as the need of big amount of top soil, difficulty in transporting seedlings caused by heavy weight and easily affected ecologically. Therefore, another kind of pot medium should be established in order to solve the above problems. The best pot medium should be light, well drainage, and uniformly composed. Kind of pot medium which is exactly suited for it is peat soil. A big amount of peat could be found at South Sumatera. Peat, however, needs certain treatment before used for pot medium because of their acidity. Treatment applicated for decreasing the acidity is by adding dolomite substance to the medium.

In order to support reforestation program through improving the methods of seedling production, a trial on two kinds of pot medium for 5 species had been established. The methods of trial are as follows :

A : A mixture of top soil, sand, and compost with the ratio of :

7 : 2 : 1.

B : Peat (collected from Delta WTelang-South Sumatera).

Dolomite added to A and B is :

- I. 1. A without dolomite (control)  
 2. A + 2 grams of dolomite/pot  
 3. A + 4 grams of dolomite/pot  
 4. A + 6 grams of dolomite/pot  
 5. A + 8 grams of dolomite/pot.

- II. 1. B without dolomite  
 2. B + 2 grams of dolomite/pot  
 3. B + 4 grams of dolomite/pot  
 4. B + 6 grams of dolomite/pot  
 5. B + 8 grams of dolomite/pot.

Besides dolomite, TSP and NPK fertilizers of 1 gram/pot added to both A and B media. Total number of seedling observed are 12,000 of 5 species chosen which consisting of :

a. <u>Swietenia macrophylla</u>	2,400 pots
b. <u>Eucalyptus deglupta</u>	2,400 pots
c. <u>Eucalyptus alba</u>	2,400 pots
d. <u>Schima bancana</u>	2,400 pots
e. <u>Acacia mangium</u>	2,400 pots.

Preliminary result of the trial can be described as follows :

1. The growth of seedling on A method without dolomite, added with NPK showed an evidence which is better than with dolomite.
2. There is no difference in growth between A method wether added with dolomite or not.

3. There is no difference in growth between B added with NPK/TSP or dolomite.
4. Generally, the growth of seedlings on peat medium is better than a mixture of top soil, sand, and compost.

## II. P L A N T A T I O N

### 1. Trial on herbicide application for reforestation

- a. Herbicide is one of chemical substances which is particularly used for killing alang-alang or shrubs. The herbicide has been widely used by the Estate Crop in order to prepare its plantation site.

Nowadays, the Ministry of Forestry is planning to develop the application of herbicide for especially site preparation activity. Other methods to kill alang-alang are biological and mechanical manners or a combination of them.

- b. This trial is aimed to look for a suitable technique from the view of effectiveness and economical aspects especially on plantation site preparation activity in suppressing the growth of alang-alang. Kind of herbicide used is glyphosate (Roundup).
- c. Method of spraying is total spraying by VLV 200 nozzle, boom sprayer and micromax. Dose of testing used is VLV 200 and the amount of herbicide applied are 5 liters/ha and 6 liters/ha. Planting of trees is done six months after spraying. The tree species chosen is Acacia mangium.



- d. From the view of effectiveness of herbicide application, regrowth of alang-alang at rate of 5 liters/ha is more suppressed than the rate of 6 liters/ha area. Other weed regrowth, however, better at 5 liters/ha area, the table below shows preliminary result of the trial.

Table : The regrowth of alang-alang and weed after spraying.

Dose testing	Regrowth of alang-alang	Regrowth of other weeds	Total
5 ltrs/ha	322	995	1,317
6 ltrs/ha	414	502	916

- Notes : - Observation is conducted 4 months after spraying  
 - Size of observation plot is 2 m x 2 m.  
 - Each dose has 6 observation plots.

- e. Herbicide could kill alang-alang quickly and decay it 4 - 5 months after spraying. But during critical time, 1-3 months after spraying, it is noticed that there is big amount of dry material of alang-alang which is easily burnt, so that special protection measure such as fire-breaks construction surrounding the trial site is required.
- f. Observation on the effect of herbicide to the trees has not been conducted yet, because of the planting activity was just made in the middle of February, 1985. This observation will be continued up to March 1986.

### III. FOREST PROTECTION

#### 1. Trial on yellow fire break as forest fire control.

The trial is intended to find out the effectiveness of yellow fire break as forest fire control.

Fire break is divided into 4 treatment, viz :

1. Cutting
2. Land Clearing
3. Land Clearing, one time ploughing
4. Land Clearing, two times ploughing.

Width of each treated fire break is 8 meters, and 100 meters in length. Firing then done at this trial is in area of 5.5 ha. Observation was then conducted to find out the most effective yellow fire break.

Result of this trial can be reported as follows :

1. Yellow fire break has good response for forest fire control.
2. Yellow fire break with land clearing and two times ploughing achieves the best method for forest fire control. Yellow fire break with land clearing and one time ploughing, however, is enough for establishing forest fire control.
3. Forest road can be utilized as yellow fire break for forest fire control. Yellow fire break will be in good function continuously if maintenance is made 4 times a year.

#### IV. STUDY ON AGRICULTURAL PATTERN IN AGROFORESTRY AREA

For developing an Agricultural Pattern in Agroforestry, it is very important to make demonstration of it. This study is also for producing good seed of some crops, and to make cost analysis of agricultural pattern.

It has been tried to plant paddy varieties of C-22 and Medan, green bean, long bean, soy bean, and others. In this study, fertilizers (TSP and Urea) are used. The growth of paddy and beans is good. However, problems setting down the harvest value born, i.e. pest and diseases attacked and destroyed them. Especially, wild pig destroyed the green bean, maize, and long bean. Therefore, the result of study of Agricultural Pattern in Agroforestry for the first planting season was failed.

For information, killing wild pig had been tried by poisoning and hunting them, but the result has not been satisfied yet.

TECHNICAL COOPERATION  
THE TRIAL PLANTATION PROJECT  
IN BENAKAT, SOUTH SUMATERA  
( ATA - 186. )

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TECHNICAL REPORT  
OF THE TRIAL PLANTATION PROJECT IN  
BENAKAT, SOUTH SUMATERA  
1985 / 1986

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MINISTRY OF FORESTRY  
DIRECTORATE GENERAL OF REFORESTATION AND LAND REHABILITATION  
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## TECHNICAL REPORT

### I. FIRE PROTECTION SYSTEM

The Trial Plantation Project ATA-186 in Benakat already have developed a Fire Protection System which is mainly stressed on 2 method namely preventive and represive method.

#### 1. PREVENTIVE METHOD

Preventive method has been carrying out by means of 2 ways such as approachment to the community near by and the construction of forest fire control facilities.

a. Approach to the community nerby has been dealing with through the following activities :

- 1) Holding the meeting.
- 2) Making leaflet, booklet.
- 3) Making billboard, attention board and soon.

b. Construction of facilities and infrastructure including the construction of for road (Main road and working road), yellow fire belt, Green fire belt, Natural fire belt, look out tower, Pond, Base camp, and Agroforestry.

#### 2. REPRESSIVE METHOD

Repressive method has been actually undertaken by setting up an organization, communication network, provision of machines and equipment of fire control as well as implementation of appropriate techniques of fire fighting.

a. Organization

Generally, the type of fire control organization will depend on the area of forest to be protected (eg. BKPH, KPH etc.) in the Project. Organization of forest fire fighting implemented can be referred in appendix 1.

b. Communication Network

For supporting the abovementioned repressive method, a patrol team has been appointed which is completed by radio communication such as CB radio set up in vehicles as well as handy talky for motorcycles. The patrol team should be ready for communicating with the control centre in base camp.

c. Machines and Equipment

Machines and equipment used consist of :

1. Transportation vehicles : truck, jeep, pick up.
2. Radio communication : Citizen Band Radio (CB), Handy talky.
3. Fire fighting tools : Jet Shooter, Fire Swatter.
4. Heavy duty machines : Tractor, Bulldozer, Water Pump.
5. Others : Safety Shoes, Safety Helmet.

d. Techniques of Fire Fighting

The implementation of fire fighting techniques will fully depend on some factors such as fire condition, topography, wind (speed and direction), type of fuel burned etc.

Based on experience in Benakat, appropriate and suitable techniques of fire fighting are as follows :

1. Making temporary fire belt with  $\pm$  6 meters wide using heavy duty machines (tractor or bulldozer).

## 2. Fire fighting

- a. In case of big fire (± 4 m height, there are 3 technics should be done through the following steps :

Don't attack the fire directly, but wait it up to ± 2 m height, and then attack it.

Watering along-alang by Jet Shooter ± 10 m in front of fire.

Do back firing in case of small fire with ± 1 - 2 m height it can be directly suppressed by using jet shooter and fire swatter

## 3. Fire fighters and their tools

In fire fighting the fire fighters should be divided into 3 groups according to the tool used, they are as follows :

- a. Jet shooter group consists of 2 - 3 person for spraying water directly to the fire continuously.
- b. Fire swatter group consists of 2 - 3 persons with duty to suppress the fire continuously.
- c. Combination between Jet shooter and Fire swatter group consist of 2 jet shooter + 2 fire swatter.

## e. Reporting

If forest fire occurs a report have to be made which mentions the loss of damage or burnt forest. The report should consist of :

1. Kind of species burnt out.
2. The cause or source of fire.
3. Speed and direction of wind
4. Fire condition.



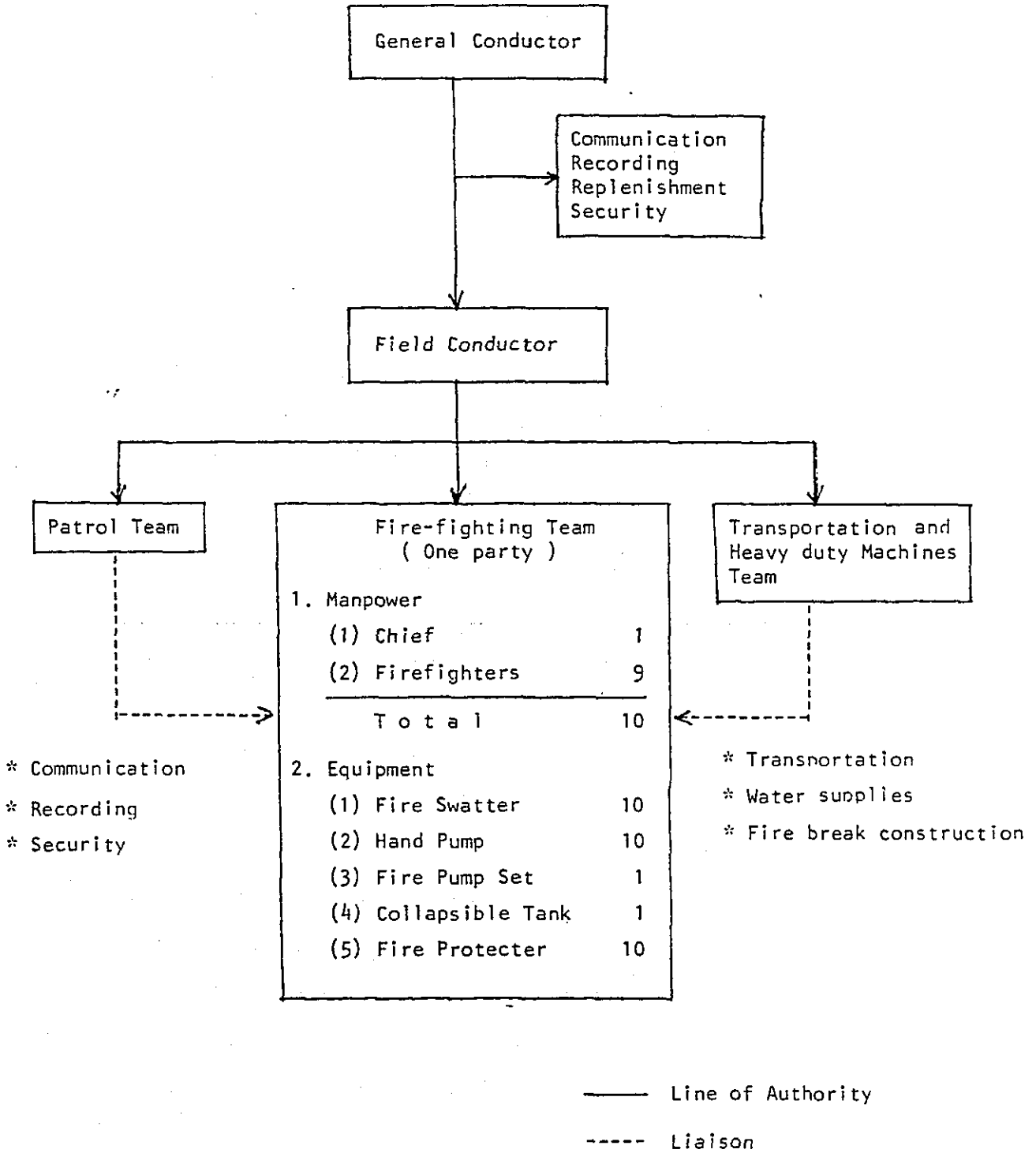
5. Time and duration of fire.
6. Total of area burnt out.
7. Plantation area burnt out.
8. Mapping of areal, or forest burnt out.
9. Estimation of loss.
10. Others.

## II. AGROFORESTRY SCHEME

Based on three years experience (1982/1983-1984/1985) in implementing Agroforestry, the preliminary result achieved are as follows :

1. Two types of cropping pattern were used by the farmers :
  - a. Cropping pattern I : (paddy, Chilly, Tomatoes, Vegetables) +  
(Sweet potatoes, Vegetables)
  - b. Cropping pattern II : (Peanut, Sweet potatoes) + (Peanut, Sweet potatoes).
2. The average area according to the kind of cropping are as follows :  
paddy 21.35 ha/yr (1 times planting), peanut 8.07 ha/yr (2 times planting),  
sweet potatoes 1.96 ha/yr (2 times planting), chilly, tomatoes, others  
2.76 ha/yr (2 times planting).
3. Land productivities of agroforestry site, by mechanized soil cultivation using wheel tractor with 2 times ploughing++ 1 times harrowing, is indicated as : paddy 688 kg/ha, peanut 1,084 kg/ha, sweet potatoes 2,816 kg/ha, chilly 564 kg/ha and tomatoes 1,273.8 kg/ha.
4. The cropping pattern and technique used is "Tumpangsari" with tree species of Albizia falcataria, Eucalyptus deglupta and Acacia mangium with spacing 4 x 2 m. The maximum period of Tumpangsari is 2 years. In the

Fire Control Organization



newly planted area (1 year old) some branches had to be cut (pruned) for getting more light to enable the crops grow well.

5. The cropping pattern, planting technique of crops and planting technique of seedling (tree) in tumpangsari system resulted in a high survival ratio of the trees. Based on the result of evaluation after 3 months of planting, the survival are as follows :
  - a. 1982/1983 plantation 81.82 %
  - b. 1983/1984 plantation 89.07 %
  - c. 1984/1985 plantation 96.65 %
  - d. 1985/1986 plantation 96.35 %.
6. In Agroforestry scheme in Bebakat, the combination between peanut and forest trees is better than the one of paddy and forest trees. The growth of forest trees in the first combination is faster than the one in the second. The growth of 9 months old trees are as follows :

No.	Tree species	Agricultural crops	
		Paddy	Peanut
1.	<u>Albizia falcataria</u> (cm)	143.6	262.7
2.	<u>Eucalyptus deglupta</u> (cm)	116.6	196.5
3.	<u>Acacia mangium</u> (cm)	192.1	226.2

7. Agroforestry farmers worked not only as agroforestry participant and plantation labourer, but also keeping cows, chicken and goats. For diversifying agroforestry scheme, study on bee-keeping and livestock keeping were being done. The project has already bought 3 female and 2 male cows which can be provided to 4 farmers by means of contract system.

8. For developing agricultural technique and for getting good seed easily, sample plots have been demonstrated. They are cultivated with agricultural crops 3 times annually. The study is still going on and will be finished in September 1986. The development of the technic and growth of crops was appropriately succesful. But the harvest was not because they were attacked and destroyed by pests and diseases, especially wild pig to paddy, peanut, green bean, and insects to soybean and green bean.
9. Utilization of facilities available in agroforestry scheme by farmers was not fully yet. To say example, the utilization of temporary house was 14 houses a year by permanently utilized (46.6 %), 5 houses per year by temporarily utilized (16.7 %) and 11 houses were not utilized (36.7%). Other facilities such as fruit tree garden and fuel wood tree garden untill now are not utilized yet by participants. However, the fuel wood garden is not satisfying due to the bad growth and low survival rate. For the near future the utilization of fruit tree garden needs arrangement in case of keeping before harvested, tending of the garden, and its distribution to the farmers. In addition, within 3 years fodder tree garden could not be utilized yet for cattle.
10. The participant farmers who stayed permanently in agroforestry site (using the temporary houses) have got annual income increasingly. The largest part of the income came from wages. The average annual income of the participant farmers who stayed permanently is presented in table below.

No.	Year	Source of income			Total	Remark
		Crops	Wages	Others		
1.	1981/1982	101,917	203,333	25,417	330,667	Data on 1981/ 1982 is one year before members.
2.	1982/1983	189,919	204,900	21,375	416,194	
3.	1983/1984	285,050	262,835	43,833	591,718	
4.	1984/1985	355,208	456,742	32,928	824,878	
Average		228,123	281,952	30,888	540,864	
Balance %		42.2	52.1	5.7	100	

Based on the above data, the annual income of participant farmers still depends on the chance of wages especially in reforestation activities.

### III. TRANSFER OF TECHNOLOGY

The transfer of technology was carried out not only by Experts to Counterparts and other staff concerned, but also by Counterparts to other forestry staff and people (communities). Generally, the transfer of technology has been conducted either through on-the-job training and demonstration both in the field, workshop and laboratory or through technical meeting and distributing technical publications (trial results). Kind of training having been conducted are as follows :

- a. Training by JICA side in the subject of machines and equipment

operation in Benakat on July 1985. The trainer came from Komatzu Ltd. and PT. United Tractor. The trainees were 2 operators and 5 mechanics of the Project.

- b. Training by Indonesia side such as : training course on reforestation technic and forest fire protection was held in Benakat from July 29 to September 3, 1985 which was devided into two groups with the trainees of 55 persons per group. Generally, the trainees were both forestry staff of Provincial Forestry Service and Reforestation company staff mostly came from West Sumatera, South Sumatera, Lampung, Aceh, Bengkulu, Riau and Jambi.
- c. Every year students of Senior High Schools in Pendopo came to the Project site for the purpose of observation on reforestation activities.
- d. Transfer of technology from experts to counterparts have been done through on-the-job training in daily activities and technical meeting which was held occasionally.
- e. The Reforestation Technology Centre in Benakat have already disseminated technical publication to all over forestry office throughout the region of Sumatera island, Java and other region. As many as 9 tittles of publication in 1984/1985 has sent.

#### IV. FURTHER STUDY AND DEVELOPMENT

##### A. Examination of Shading Intensity of Seedling in Nursery.

Light intensity is one of some factors needed for growing seedling and getting survival ratio after pricking up. This study already indicated that every species needed light intensity and time of shading different by each others.

The result of examination to 5 tree species are as follow :

No.	Species	Light Intensity (%)	Shading (week)
1.	<u>Acacia mangium</u>	65	2
2.	<u>Eucalyptus deglupta</u>	35	4
3.	<u>Schima bancana</u>	45	4
4.	<u>Swietenia macrophylla</u>	100	Not need
5.	<u>Albizia falcataria</u>	65	2

##### B. Two Storried Stand

Two storried stand is a combination stand by using 2 kind of storries, upper and lower parts, which can be established from the same species or different species each other. However, the first storry usually consists of intolerant species and second story of tolerant species.

In this trial, Albizia falcataria was planted as first storry and Hopea odorata as second storry. The age of A. falcataria is 4 years old when the planting activity of H. odorata was done.

Planting site located at compartment A1 (manual compartment for site preparation), and planting distance for A. falcataria is 4 x 2 m and 4 x 4 m for H. odorata. Light intensity under first story 20% - 30%.

Observation for tree growth of H. odorata was done every 3 months.

A preliminary result are as follows :

No.	Age (Month)	Mean height (Cm)	Height Increment (Cm)	Remark
1.	0	39.8	10.0	Planting data May 1984.
2.	3	49.8	-	
3.	6	76.6	26.9	
4.	9	113.7	37.1	
5.	12	127.1	13.4	
6.	15	135.2	8.1	
7.	18	164.5	29.3	
8.	21.	178.7	14.2	
T O T A L			138.9	
AVERAGE			19.8	

From the view points of tree growth, H. odorata planted under A. falcataria stand gives a good prospect in the future. However there is a bit problem faced at the site, i.e. some insects attack A. falcataria especially during dry season.

Firstly insects attacked the leaves and trunk of A. falcataria.

Afterwards, they attacked the leaves of H. odorata, but the damage is not serious.



In the future, the trial of two storied stand will be continued by making some combination of species.

### C. Study on Site Preparation

Site preparation is an integral part of plantation establishment with the aim of securing both high survival and rapid initial growth.

This is achieved by : (i) control of competing vegetation, (ii) removal of physical obstructions to tree growth, (iii) cultivation to improve soil structure primarily to aid rooting and also nutrient availability.

Mechanical site preparation is often the most costly silvicultural operation. Therefore a suitable method of mechanical site preparation for a certain species should be found out.

This trial has been done in the 1984/1985 fiscal year, 9 permanent plots have been established where each plot means the degree of site preparation, viz :

1. Land Clearing
2. Land Clearing, 1 time ploughing (total tillage)
3. Land Clearing, 1 time ploughing (strip tillage)
4. Land Clearing, 2 times ploughing (total tillage)
5. Land Clearing, 2 times ploughing (strip tillage)
6. Land Clearing, 1 time ploughing, 1 times harrowing (total tillage)
7. Land Clearing, 1 time ploughing, 1 time harrowing (strip tillage)
8. Land Clearing, 2 times ploughing 1 time harrowing (total tillage)
9. Land Clearing, 2 times ploughing 1 time harrowing (strip tillage)

One year after planting an observation for tree growth was done.

A preliminary result is described as follow :

Plot No.	Tree Height (Cm)			
	A. mangium	E. deglupta	S. macrophylla	S. walichii
1.	178	90	64	53
2.	150	107	57	53
3.	142	105	77*	72
4.	278*	134	75*	108
5.	224	127	71	132*
-----				
6.	259	114	84	84
7.	185	118	87	110
8.	220	178*	101	113
9.	236	147	106	129*

The above table shows that a complete soil cultivation (LC, PI, PII and H) gives the best influence to tree growth. However this degree of site preparation is costly or the most expensive. The degree of site preparation which secured both good tree growth and reasonable cost was Land Clearing and 2 times ploughing (strip tillage).

#### D. Effective Weeding Intensity for Selected Species

Control of competing weeds is an important part of plantation establishment. Therefore weeding activity is essential for a good early growth of mostly fast growing species during the first few years until the trees are growing well and approaching canopy closure.

Weeding activity should be done for many reason, i.e;

1. Weeds directly compete for light, soil moisture and nutrient.
2. Weeds can suppress and eventually kill trees by their shading.
3. Dense ground vegetation increases the fire hazard especially in the dry season.

The objective of trial is to examine a suitable time of weeding practice and a minimum frequency of weeding.

This trial choose 4 species to be examined, i.e. Acacia mangium, Swietenia macrophylla, Eucalyptus deglupta and Schima bancana. Duration of trial was 14 months.

Seven plots were established in each species, plot size was 0,04 ha (20 m x 20 m). Each plot means a time of weeding practice described as follow :

Plot a. : To implement the weeding at the same time the compartment.

Plot b. : Once every month.

Plot c. : Once every 3 months after planting.

Plot d. : Once every 4 months after planting.

Plot e. : Weeding interval : 2 month after planting, after that once every 4 months.

Plot f. : Weeding interval : 2 months after planting, after that once every 4 months.

Plot g. : Once every 6 months.

A preliminary result (after 1 year planting) of this trial is described as follows:

No.	Species	HEIGHT ( cm )						
		Plot : a	: b	: c	: d	: f	; g	: h
1.	<u>Acacia mangium</u>	370	479	313	343	332	312	267
2.	<u>Swietenia macrophylla</u>	127	195	169	165	181	159	164
3.	<u>Eucalyptus deglupta</u>	145	190	167	163	165	166	152
4.	<u>Schima bancana</u>	153	167	150	156	158	132	168

Notes : - Site preparation for this site was : Land Clearing and 1 time ploughing.

- Measuring tree height was done 14 months after planting.

The above table shows that the most effective weeding for tree growth is plot b.

However, this plot is not only the best for tree growth but also the highest cost for weeding practice because every month weeding was executed.

From the view points of economic and trees growth aspect plot a gave a reasonable result. Nowadays, this method is adapted at Trial Plantation Project, i.e. weeding interval 2 months after planting, after that once 3 months for 4 times.

TECHNICAL COOPERATION  
THE TRIAL PLANTATION PROJECT  
IN BENAKAT, SOUTH SUMATRA  
( ATA - 186 )

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TECHNICAL REPORT  
OF THE TRIAL PLANTATION PROJECT  
IN BENAKAT, SOUTH SUMATRA  
1986/1987

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MINISTRY OF FORESTRY  
DIRECTORATE GENERAL OF REFORESTATION AND LAND REHABILITATION  
DIRECTORATE OF REFORESTATION

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## I. INTRODUCTION

The Technical Report is prepared for the Tenth Joint Steering Group Meeting and based upon research and development until the end of March 1987. The report consist of 4 tittles and adapted by 4 activities of implementation Programme of the " Follow-Up Cooperation " of the Project, namely :

1. Techniques for counter measures against fire, insect, desease and meteorological damage.
2. Studies on the social and environmental implication of afforestation.
3. Planning, management and evaluation techniques of afforestation project.
4. Other necessary techniques.

The 4 tittle of this report are as resume of some researches and development have been done on 1985/1986 - 1986/1987.

## II. TECHNIQUES FOR COUNTER MEASURES AGAINST INSECT AND DISEASE.

Since 1984/1985 up to 1986/1987 fiscal year, the project has developed 4 trees species for trial plantation purpose namely : Acacia mangium, Eucalyptus deglupta, Swietenia macrophylla and Schima walichii Var bancana.

The growth of seedling in nursery site and trees in plantation site were good. The seedling and the trees also have been attacked by pest and diseases but not seriously yet.

The observation and extermination on pest and diseases attack on nursery and plantation site have been done as well.

The aim of the observation and examination are as follow :

1. To know the pest and diseases which attacked 4 trees species both in nursery and plantation site.
2. To know the extermination pest and diseases attacked in nursery and plantation site.

#### A. Kind of Pest and Disease

According to the observation data, the pest and disease which attacked 4 trees species in nursery site as follow :

<u>S p e c i e s</u>	<u>P e s t</u>	<u>D i s e a s e s</u>
1. <u>Acacia mangium</u>	Leaf - worm	Leaf-rust
2. <u>Eucalyptus deglupta</u>	Grasshopper	Leaf Pumpy/Leaf rust
3. <u>Swietenia macrophylla</u>	Grasshopper	Leaf rust
4. <u>Schima walichii</u>	Grasshopper	Leaf rust

The pest and diseases which attacked 4 trees species in plantation site, namely ;

<u>S p e c i e s</u>	<u>P e s t</u>	<u>D i s e a s e s</u>
1. <u>Acacia mangium</u>	-	Leaf rust
2. <u>Eucalyptus deglupta</u>	-	Leaf rust
3. <u>Schima walichii</u>	Grasshopper	-
4. <u>Swietenia macrophylla</u>	Shoot borers	-



## B. Extermination Pest and Disease

Extermination of Pest and Disease in nursery and plantation site usually used pesticides and fungicide.

### 1. For nursery site.

Kind of pesticides and fungicide which have been used in project for controlling the pest and diseases attack are as follows :

Species	Pest	Disease
1. <u>Acacia mangium</u>	Sumithion	Dithane M 45
2. <u>Eucalyptus deglupta</u>	Sumithion	Dithane M 45
3. <u>Schima walichii</u>	Sumithion	Dithane M 45
4. <u>Swietenia macrophylla</u>	Sumithion	Dithane M 45

### 2. For plantation site

The kind of pesticides and fungicide or technique which have been used in project for controlling the pest and diseases attack are as follows :

Species	Pest	Disease
1. <u>Acacia mangium</u>	-	Dithane M 45
2. <u>Eucalyptus deglupta</u>	-	Dithane M 45
3. <u>Schima walichii</u>	Sevin 85 SP	-
4. <u>Swietenia macrophylla</u>	Prunning	-

### 3. Implementation

Implementation in nursery site, utilization of pesticides for every 2 weeks since the seedling 2 weeks old to 3 months old. Sumithion with concentrate 3 ml per liter of water and Dithane M 45 with concentrate 2 gr/liter of water.

Implementation in plantation site, utilization of pesticides and fungicides depend on intensity of attack for every kind of pest and disease.

Usually, spraying of pesticides and fungicides every 2 months for 3 times. Using Sevin 85 SP with concentrate 1 kg/ha, also Dithane M 45 by concentrate 1 kg/ha.

Pruning of branches of Swietenia macrophylla because shoot borer usually every 3 months together with weeding activity.

## III. AGROFORESTRY ACTIVITY.

### A. Background

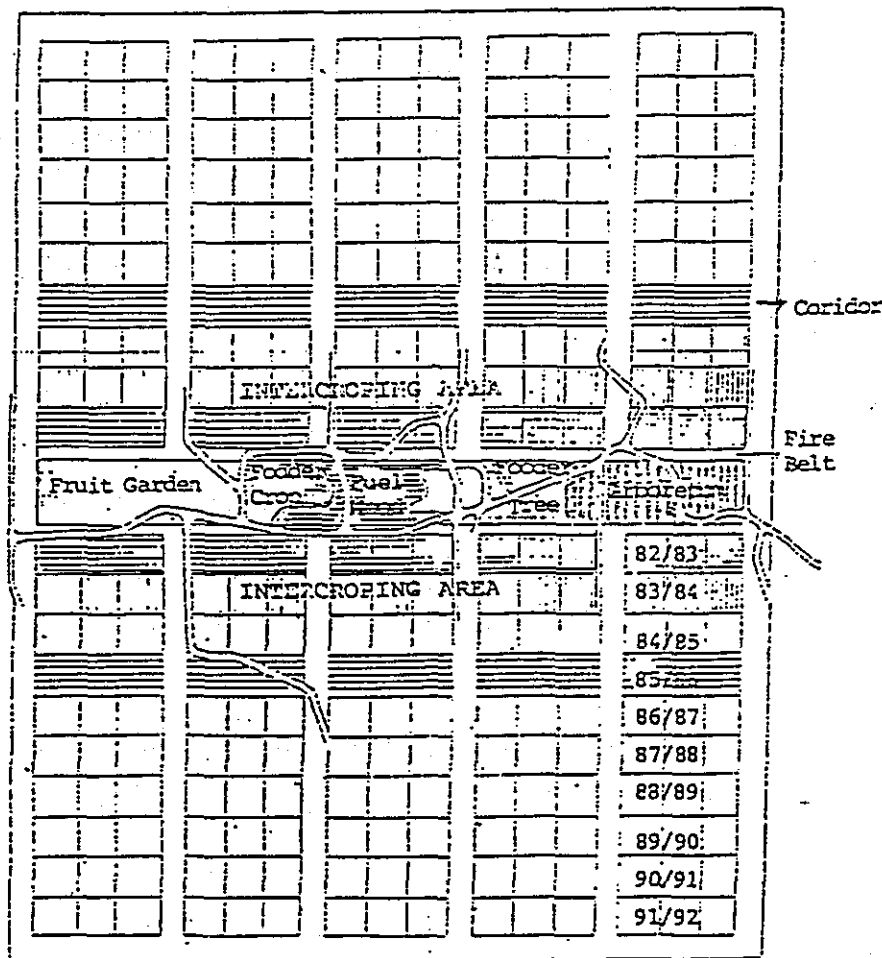
Agroforestry activity in the project is any one of the trials on the application of agroforestry patterns in the grassland area.

The agroforestry was initiated in 1982/1983 and aimed at finding the agroforestry system which is suited for the grassland area by involving local inhabitants i.e. shifting cultivators, local farmers etc.

By establishing the agroforestry activity, forest plantation will grow soondly without any disturbances and the socio-economic welfare of the people surrounding will also increase.

B. Agroforestry Lay Out in The Project.

The total areas of agroforestry is 435 ha consisted of 40 ha for demonstration area including forest road, fire breaks and other supporting facilities, 300 ha for intercropping plantation area including working roads and 85 ha for corridor fire breaks (see Map 1).



Map 1. Agroforestry lay out in the project.

1. The demonstration area.

The area is divided into seven areas i.e fodder trees area, arboretum area, fuel wood area, fire breaks area, fodder crops area, fruit trees area and facilities area. The central area in agroforestry site contains some necessary facilities such as roads, look out tower ( 1 unit), washing place (1 unit), toilet place ( 1 unit ) temporary houses (30 units) and pond (1 unit).

2. The intercropping area.

One hectare of two times ploughed and one time harrowed is allocated for each farmer every year. The land to be required for ten years will be provided in the agroforestry site. Each farmer has to plant trees in the allocated lot in accordance with the contract. Agricultural activities are permitted in each lot during two years.

C. 1985/1986 - 1986/1987 Agroforestry Activities.

1986/1987 agroforestry activity in the project is the fifth year implementation. The condition of agroforestry during 1986/1987 can be described as the following items :

1. The number of farmers since 1982/1983 - 1986/1987.

Y e a r	Participants	Participants out	New participants in
1982/1983	30	6	6
1983/1984	30	12	12
1984/1985	30	9	3
1985/1986	24	6	1
1986/1987	19	PM	PM

The number of farmers in 1986 /1987 are only 19 participants Or 64 % of 30 farmers targeted every year. It consists of 10 farmers (1982/1983), 2 farmers (1983/1984), 5 farmers (1984/1985), 1 farmer (1985/1986) and 1 farmer (1986/1987).

There has been a decrease in the number of agroforestry participants in 1985/1986 and early 1986/1987, it caused by the yield of agricultural crops that hasn't successfully yet.

It makes the agroforestry activity is less interested to the farmers. But in the last year of 1986/1987 where the yield of agricultural crops is increased/more better than the years before, the number of agroforestry participants in 1987/1988 are increased to 27 participants.

2. Every farmer have been given some subsidies from the project such as fertilizer (100 kg Urea and 100 kg TSP), poison (1 bottle Temik) for suporting the agricultural crops increases.
3. Based on the result of home economic suvey conducted in 1986/1987, every farmer needs Rp. 662,722,- for daily necessary with the rank of priority for rice (49.5 %), sugar (7.4 %) and spice (7.0 %) and others.

The average income of farmers from Paddy + peanut in 1985/1986 only Rp 86,840,- but in 1986/1987 already Rp. 226,600,-

The comparative yearly farmers income from agricultural crops for the daily foods in 1986/1987 is 40.2 % which is better than in 1985/1986 = 13.1 %. Most of the total of farmers income come from salary obtained from working outside agroforestry activity.

4. The yield of agricultural crops in 1986/1987 is higher compare with 1985/1986, for example :

	1986/1987	1985/1986
- P a d d y	1060 kg/ha	435 kg/ha
- P e a n u t .	1400 kg/ha	540 kg/ha

In 1986/1987, there is a good development in cropping planting usually the farmers planted peanut 2 times per year (October-January and January - April), but in 1985/1986 some farmers have been brave enough to plant peanut three times per year i.e. October - January (13 farmers), January - April (11 farmers) and May - July (5 farmers).

#### IV. TRIAL ON PLANTATION TENDING OPERATIONS

Several agricultural operations are needed to ensure a plantation is adequately established and protected up to the production stage. Some of them are weeding, pruning and salvage cutting.

The aim of weeding is to release grasses, herbs, and shrubs which directly compete with planted trees for light, soil moisture, and nutrients purposes. Almost all plantations require some weeding activity during the first few years until the trees are able to grow well and approach canopy closure.

Weeding trial which have been already executed in the project are manual weeding and chemical weed control.

Manual weeding using bush knives etc to cut away the weed is the commonest method. Objective of the trial is to observe the influence weeding intensity to the growth of selected species. Weeding intensity varies from once a year, twice a year until 12<sup>th</sup> a year. The method is restricted to line weeding.

The height in average for 4 trees species at 15 months old are as follow.

Table 1. Total tree height in average

Wedding Intensity	S P E C I E S			
	A. mangium	E. deglupta	S. macro phylla	S. bancana
1 time a year	217 cm	145 cm	101 cm	144 cm
2 times a year	234 cm	164 cm	114 cm	163 cm
3 times a year	242 cm	172 cm	122 cm	172 cm
4 times a year	362 cm	194 cm	126 cm	178 cm
6 times a year	370 cm	217 cm	136 cm	183 cm
12 times a year	410 cm	247 cm	164 cm	209 cm

The result have showed that 4 times weeding per year was the best intensity from the view points of tree growth and economical aspects for Acacia mangium, Eucalyptus deglupta, Swietenia macrophylla and Schima walichii Var bancana.

Chemical weed control using glyphosate killed alang-alang directly. The method and tree species used the same as above.

Application of herbicide was carried out using knapsack sprayer with VLV - 200 Nozzles. The dosage was 2,5 liters per ha. The result of observation in the field showed that glyphosate has had some advantages, especially for the suppression of alang alang growth, viz :

- 1). By means of one application it would provided long lasting control.
- 2). Dead weeds (alang-alang) were left could be acted as a mulch and the reduction of the risk of soil erosion.

Survival rate of 4 trees species whether before herbicide application or after are as follows.

Table 2. Survival rate of tree species.

S p e c i e s	Before Application	After 1 <sup>st</sup> application	After 2 <sup>nd</sup> application
<u>A. mangium</u>	84 %	81 %	80 %
<u>E. deglupta</u>	88 %	53 %	28 %
<u>S. macrophylla</u>	83 %	71 %	57 %
<u>S. walichii</u>	85 %	83 %	82 %

Remarks : 1). Survival rate observed 3 months after application  
 2). Interval between 1<sup>st</sup> and 2<sup>nd</sup> application were  
 1 year.

It could be concluded that glyphosate didn't only kill alang-alang but also made survival rate of Eucalyptus deglupta and Swietenia macrophylla decrease.



On the contrary, there is no affects to the growth of Acacia mangium and Schima walichii Var bancana.

Salvage cutting concerned with removal or killing of perennial plants, unwanted trees, vines and creepers. It should be done to ensure full release of the tree in direct plantation.

This activity ensured that planted trees receive not only overhead light but has had adequate lateral space as well.

The operation of salvage cutting usually execute with other activity in accordance with tending. In this case salvage cutting has been done together with pruning.

Pruning is the removal of branches which aim to produce timber free from knot. Both pruning and salvage cutting were the few opportunities to improve wood quality.

The trial execute for 3 level of height of pruning, viz. 0 %, 50 %, and 66 %. 0 % pruning means no pruning is done except the removal of basal shoots (if it is founded). 66 % pruning means the trees pruned to 66 % of total height. Salvage cutting has been done at all level pruning area. The tools used for pruning was axe or a pruning saw which depending on diameter of branches. The result of field measurement can be described as follows.

Table 3. Height increment

<u>S p e c i e s</u>	<u>0 % Pruning</u>	<u>50 % Pruning</u>	<u>66 % Pruning</u>
<u>A. mangium</u>	282 cm	375 cm	381 cm

<u>E. deglupta</u>	144 cm	92 cm	159 cm
<u>S. walichii</u>	83 cm	166 cm	95 cm

Table 4. Diameter at Breast Height increment.

<u>S p e c i e s</u>	0 % Pruning	50 % Pruning	66 % Pruning
<u>A. mangium</u>	22 mm	34 mm	48 mm
<u>E. deglupta</u>	6 mm	7 mm	9 mm
<u>S. walichii</u>	20 mm	20 mm	18 mm

- Remarks : 1). Measurement was executed 1 year after pruning application.
- 2). The age of tree when it was pruned are 3 years ( A. mangium, S. walichii ), and 4 years ( E. deglupta )
- 3). Spacing is 4 x 2 m for all tree species.

The result have showed that 66 % pruning was suitable treatment for A. mangium and E. deglupta, and 50 % pruning was suitable treatment for S. walichii.

## V. STANDARD OF ACTIVITY AND STANDARD OF COST

### A. Background

Based on using of nursery equipment, it can be separated into 3 kind e.g. manual, mechanize and semi mechanize nursery.

Based on stationery nursery can be devided into 2 kind e.g. permanent and unpermanent nursery. Benakat nursery include in semi mechanize permanent.

Nursery activity are started since 1980 until now.

Benakat nursery have used machine equipment for some activities like soil collection, media processing and transportation. Beside that also have been built the permanent infrastructure like office, permanent bed, potting house etc, therefor can be operated for long time. Until now Benakat nursery producted amount 5.6 million seedlings.

Nursery consist of some activities. To understand the standard of activity and standard of cost necessities ought to be done the observation of work achievement and cost analysis at seedling production amount 400,000 seedlings.

### B. A i m

The aim of this observation for understanding work achievement each nursery activity and cost accounting for producing the seedling amount 400,000 seedlings.

### C. Method

#### 1. Work achievement observation.

The method is used time study and achievement for every activity during 7 hours.

Normal work achievement is founded from the average of some samplings. The total Man days can be calculated by adding the Man days of all activities.

#### 2. Observation of Cost Standard.

In this observation, the cost divided into 2 categories e.g. fixed cost and variable cost. Variable cost consist at wage, materials and manual equipment. Fixed cost consist of machine equipment, infrastructure and salary of operator and supervisor.

##### a. Variable cost.

Cost of wage is total Mandays time daily wages, and cost of material calculated by total material time of the market price.

##### b. Fixed cost.

Cost of machine equipment calculated based on buying price and cost of infrastructure calculated based on contract cost with the contractor.

The operator salary calculated during 1 year budget.

### D. Result .....

D. R e s u l t

1. Standard of activity.

Activities	Unit	Work achievement	Need of Mandays
1. Clearing	Bed	2.5	43.2
2. Inspection Road	M <sup>2</sup>	30	285
3. Draination Channel	m	40	58
4. Soil collection	m <sup>3</sup>	5	74.8
5. Soil screen	m <sup>3</sup>	1.5	124.7
6. Mix of media	m <sup>3</sup>	1.65	147.3
7. Hole plastic pot	kg	12	27.5
8. Fire wood collection	m <sup>3</sup>	1.2	6.7
9. Burn of sand	m <sup>3</sup>	0.4	52.5
10. Sowing of seed	box	31	46
11. P o t t i n g	pot	640	687.5
12. Pricling	pot	1,670	263.5
13. Watering	bed	51	372
14. Shading	bed	18	6
15. Replanting	pot	1,200	73.3
16. Fertilizing	bed	12	2.7
17. Weeding	bed	1.2	270
18. First selection	pot	2,200	200
19. Pest and disease spraying	bed	32	82
20. Last selection	bed	0.6	180
21. Controlling	Hok	1	300
			3,302.7

2. Standard of Cost.

C o s t	Cost per unit (400,000 seedling) ( Rp )	Cost per seedling ( Rp )
<u>I. Variable cost</u>		
a. Wages amount 3,302.7 Mandays a Rp 1,250,-	4,128,375	10.32
b. Material, plastic pot, sand, compost, seed, oil etc.	4,400,000	11
c. Manual equipment	255,000	0.64
T o t a l      I	8,783,875	21,96
<u>II. Fixed Cost</u>		
a. Equipment by machine (Iseki tractor, Yanmar, soil mixing etc) to account 1 year	8,496,321	21.24
b. Infrastructure (permanent bed, potting house, sowing box, office etc) to account 1 year.	3,781,493	9.46
c. Operator salery (1 Super visor, 3 operator) to account 1 year.	2,244,000	5.61
T o t a l      II	14,521,814	36,31
T O T A L    I + II	23,305,689	58.27

Subject

ANNEX F

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PLAN OF OPERATION 1987/1988

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