Appendix 6.

Jakarta , 29 November 1980.

Dear Mr. Apandi,

We, the Japanese Advisory Team, are very sorry to learn that you have been unwell these days. Although we hoped to see you again here and discuss with you closely on the Operation of the South Sumatera Afforestation Project, we should like to wait for another opportunity and wish you a very quick recovery.

Inspite of a limited time, we have been able to visit Benakat and see the Project Operation. We are pleased to inform you that we are generally happy with the progress being made. After detailed discussion with Mr. Kato, the Chief Adviser, Mr. Ohmi, the Team Leader, and other experts, we advised them on the following points.

(1) To maintain close relation with the counterpart staff in planting and implementing the project (please note that this does not mean the present realtion is bad, but we felt that it can be made closer).

(2) To take into consideration more carefully the local social economic conditions in carrying out the project.

Our impression on the performance of our experts is generally good. In view of the small problem encountered when the proposed Mr. Tashiro, we carefully checked his performance. He is a quiet but very sincere worker and we are very happy with the progress hi is making at present. We would therefore like to propose his extension for another year and in total two years. As we need a series of administrative actions on our side to effect extension, your agreement to this proposal at your earliest convenience will be very much appreciated.

Once again, we wish you a very quick recovery and hope to see you again the near future.

Your Sincerely,

with warm regards.

(T. Matsuda)
Director, Planning Division
Forestry Agency.

Signed

(K. Wanatabe)
Director, Forestry & Fishery Division
Japan International Cooperation
Agency.

DIREKTORAT JENDERAL KEHUTANAN

Appendix 7.

DIREKTORAT REBOASASI DAN REHABILITASI

ATA - 186 : TRIAL PLANTATION PROJECT IN BENAKAT

Alamat : Jl. Gunung Batu - Tilp. 23565-Kotak Pos 42 Bogor.

Nomor : 039/JICA/B/1981.

Bogor, 1st October 1981.

Lampiran :

Perihal :

Mr. Zulkifli Mulsani
Field Manager for ATA - 186.

Dear Sir,

Thank you very much for your kind cooperation and eager effort to implement the trial plantation project in Benakat.

Recently, I have received the report of the technical meeting on the result of observation at the plantation site by Mr. Sagala, co-project manager for ATA - 186, and in his report I have noticed that the survival percentage of the trial plantation in 1980/1981 was not so good in general and especially the percentages of Pinus merkusii and Eucalyptus urophylla were very low.

As you know, the survival percentage of planting seedlings is most important factor to judge the success or failure of administrative and technical activities in the nursery and plantation.

Generally, almost all the foresters are making their efforts very hard to raise the survival percentage by improving the nursery and planting techniques. Accordingly, I want to know the real survival percentage of each planting species in 1980/1981 after the dry season, and also the reason why the percentage were not so good because we have to consider the counter-measure for it.

And also I heard from our expert that in 1980/1981 the soil improving trees, Leucaena leucocephala, were not mixed with the other planting species and also the experimental plots for the fertilizer were not yet established. However, it is some change of the annual operation plan, so that I would like to know the real situation and the reason for them.

Could you please arrange the report concerning these problems and send to me as soon as possible.

Thank you for your kind cooperation.

Sincerely yours,

Ryosuke KATO

Chief Adviser
for ATA-186.

C.C.

1) K.OHMI: Japanese team leader and expert for silviculture for ATA-186.
2) Ir. Anto Rimbawanto: Counterpart for silviculture for ATA-186.
3) Ir. Soedjadi Hartono: Project co-manager for ATA-186.

DEPARTEMEN PERTANIAN
DIREKTORAT JENDERAL KEHUTANAN
PROYEK PERENCANAAN DAN PEMBINAAN REBOASASI DAN
PENGHIJAUAN DAS MUSI SUMATERA SELATAN
BAGIAN PROYEK KERJASAMA LUAR NEGERI (JICA)
Jalan Jaksa Agung R. Soeprapto No. 26 Telp.22158 Kotak Pos No. 179.
P A L E M B A N G

Nomor : 172/KG-KG/10/1981.
Lampiran : -
Perihal : -

Palembang, 13 October 1981.

Dr. Ryosuke Kato
Chief Adviser for ATA - 186
Directorate of Reforestation and
land Rehabilitation.
Jalan Gunung Batu P.O. BOX 42.
B O G O R

Dear Sir,

Thank you very much for your letter regarding to the progress of this project.

I, hereby would like to inform you that the present situation of our plantation site. According to the latest evaluation we made on September 1981, survival percentage of the 1980/1981 plantation are as follow : Albizzia falcataria 87 %, Switenia macrophylla 89, 2 % Eucalyptus urophylla 67 % and Pinus merkusii 52,3 %.

I am on the same opinion with you, that survival percentage of planting is the most important factor to judge the succsess or failure either for nursery or plantation activities. Therefore we've been trying to analize and to find the main causes of the failure, if we can say so, and have made some effort to improve it. Actually the low percentage of P. merkusii and E. urophylla were not so suprising to me, as we have considered before. Thre are some factors which make the failure of P. merkusii and E. urophylla, these are :

1. Quality of seedlings ; as you know, execution of the project in 1980/1981 was not run smoothly, and this was affected to another activities, without exception nursery and plantation activities. At the time, planted seedlings were not fulfil the conditions, mainly height and diametr of seedlings , especially for P. merkusii. Average height of planted seedlings are only 10 - 15 cm, and 2 - 3 mm for diameter. Furthermore, it seem that they were to weak to be planted, because the growth indicator was not existed yet. E. urophylla has rather different situation. Production of eucalyptus seedlings were only 30 % of the target, and it is not sufficient for 50 ha plantation. Almost of them were took from Subanjeriji project. The quality was also not good, however, perhaps due to the long time of transportation and the weather condition. Most of them become weak.

2. Time of planting ; prolongation to raise- up seedlings so as to fulfil the conditions, has made time of planting delay. Implementation of planting for E. urophylla was done at the beginning of March, and P. merkusii at the end of March. Sooner afterward, the rainfall was decreased, and this was become a critical situation foe them to survive.

3. Another factors should be taken into consideration to reach high survival percentage, are treatment of seedling during transportation of site for planting. At there was a possibility for those three factors to contribute the failure of P. merkusii and E. urophylla and probably to another species, in the 1981/1982 plantation we'll make some improvement/

Regarding to the experimental plots for fertilizing study, I hereby report if we have established experimental plots for that purpose at A. falcata and S. macrophylla compartment, and we have also implemented this experiment. Implementation of fertilizing study for A. falcata and S. macrophylla were done at August and September, respectively.
In the 1980/1981 plantation, the soil improving trees, Leucaena glauca were not mixed with the main planting species, because of some reasons.
Budget for produce L. glauca seedlings did not included in 1979/1980 –

- nursery budget. Meanwhile, I think it is not suitable to plant by direct seeding because it needs a special condition such as intensive cultivation to improve soil texture, and finally will improve soil aeration which is an important factor for growing. However, as this project is a trial plantation project, mixing of soil improving trees with the main species should be tried and will be implemented in 1981/ 1982 plantation.

Finally, I hope that these information will be useful, and we are expecting for your further guidance and suggestions.

Thank you for your kindness.

Best wishes.

Zulkifli Mulsani.
Field Manager for ATA - 186.

c.c.

1. Mr. Soedjadi Hartono, Project Manager for ATA - 186
2. Mr. Wazir Nengkeman , Project Manager for DAS MUSI. S.S.
3. Mr. Katsuyuki Ohmi , Expert of Silviculture for ATA - 186.

Appendix 8.

REFORESTATION TRAINING CENTER
BENAKAT, SOUTH SUMATRA, REPUBLIC OF INDONESIA

Mr. APANDI MANGUNDIKORO
Director of Reforestation and Rehabilitation
Directoarte General of Forestry
Ministry of Agriculture

Dear Sir,

We have the pleasure of submitting herewith a report on the Basic Design Survey for the Reforestation Training Center to be constructed at Benakat, South Sumatra.

We wish further to prepare the basic design of the Training Center in accordance with the results acquired through discussion with the authorities concerned and our survey.

We would like to express our deepest gratitude to you and all the officials concerned for the kind assistance and cooperation extended to our survey team during our stay in Indonesia and hope that the result of the mission will contribute to further the friendship between Japan and Indonesia.

February 17 , 1981

K. Takahashi

Kunio Takahashi
Team Leader
JICA.

BASIC DESIGN FOR
REFORESTATION TRAINING CENTER
BENAKAT, SOUTH SUMATRA, REPUBLIC OF INDONESIA

1. General

A team organized by the Japan International Cooperation Agency headed by Mr. Kunio Takahashi has been dispatched to Indonesia and performed survey from February 9 thru February 18 on the basic design for the Reforestation Training Center at Benakat, South Sumatra, upon the request of the Directorate General of Forestry, Ministry of Agriculture.

The team held discussion with officials of the authorities concerned and made surveys of the Benakat Site arriving at the result as hereinafter designated in the Scope of Works which are expected to be covered by the Grant Aid by the Japanese for the anticipated Project.

2. Scope of Works

The scope of works to be covered by the Grant Aid for the Reforestation Training Center shall be as indicated below and further shown in the attached drawings is omitted here.

a) Buildings :

- Machinery Workshop
- Dormitory Building

b) Utilities :

- Water Supply Facilities
- Sewerage and Drainage Facilities
- Electrical Facilities.

c) Extent of Facilities to be Provided :

i) Machinery Workshop :

The Machinery Workshop shall be constructed of steel structure and provided with hoist crane, shelves, water supply and electrical facilities.

ii) Dormitory Building :

The Dormitory Building will be for bachelor quarters including guest room, meeting room, dining room and employers quarters. The building will be of brick structure and provided with water supply, sewerage, drainage and electrical facilities.

iii) Water Supply Facilities :

The water supply will be obtained from rain water collected into a storage lakeand river water pumped from a nearby river during the dry season.
The Indonesian Government side will provide the storage lake, a simple filter tank, water storage tank, a high gravity tank and the pipings and pumps necessary for pumping the filtered water to the high tank.
The works to be covered by the Grant Aid will be the purification and distribution of the supply water to each of the required points of delivery.

iv) Sewerage and Drainage Facilities :

The sewerage system will be made complete by providing septic tanks and drainage into the ground by the seepage system.
The drainage of the waste water and rain water will be collected and drained out of the site.

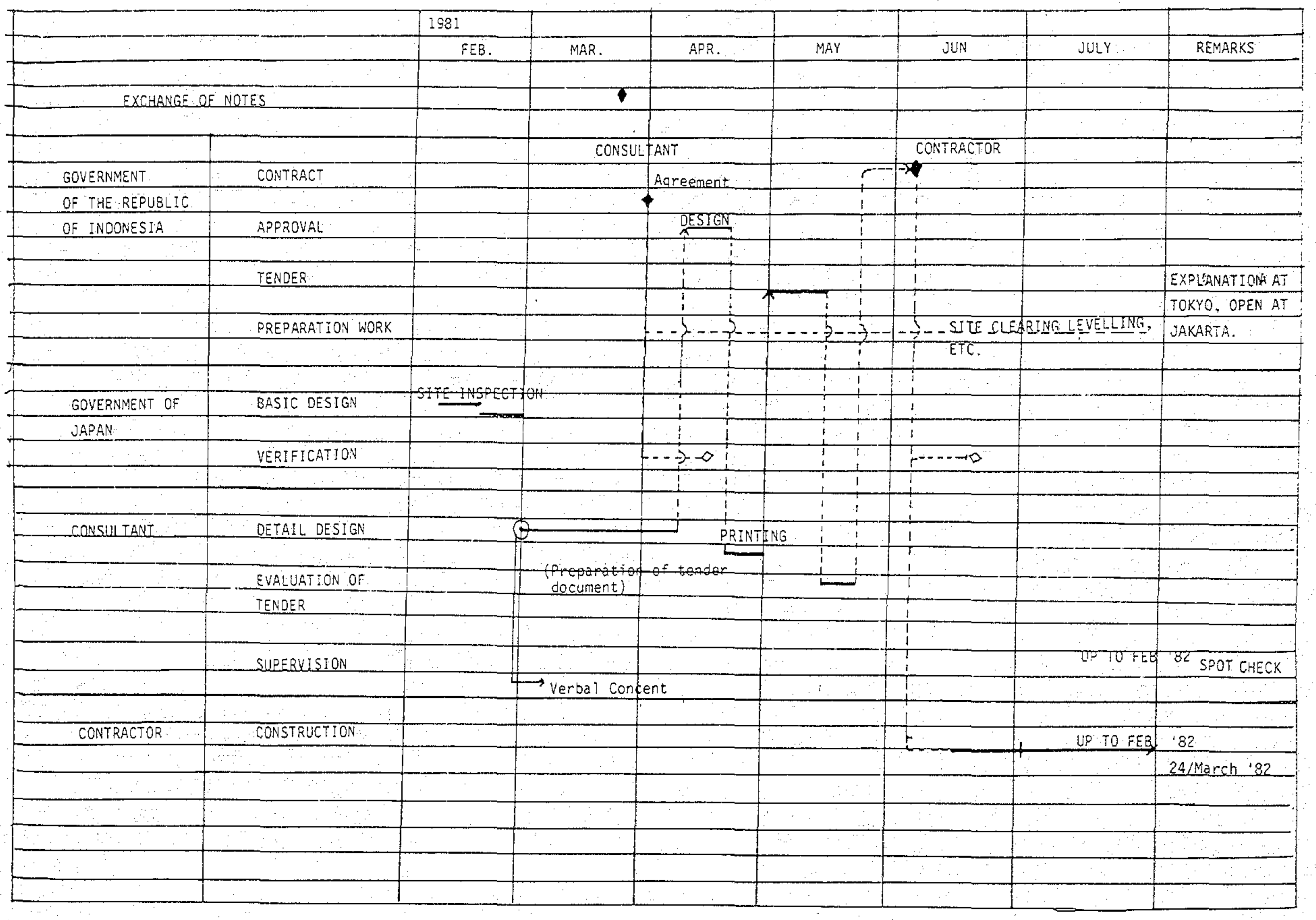
v) Electrical Facilities :

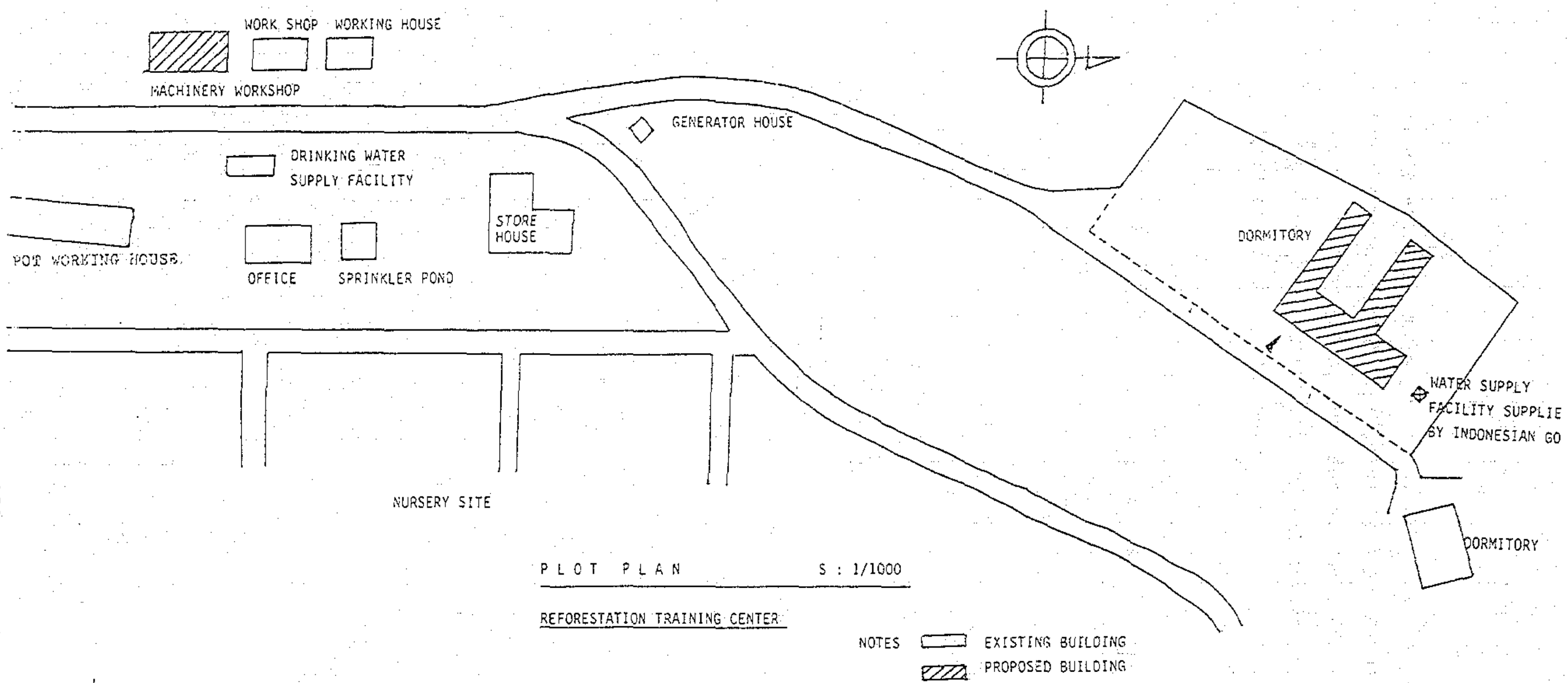
The electric source will be obtained from the existing generator.

The electrical works to be covered by the Grant Aid will be the outdoor distribution works from the point of delivery near the site (to be provided by the Indonesian government side) and the distribution of electricity to each of the required points of delivery.

NOTE : The attached maps on the layout of the buildings and the table for the schedule of procedure are omitted here.

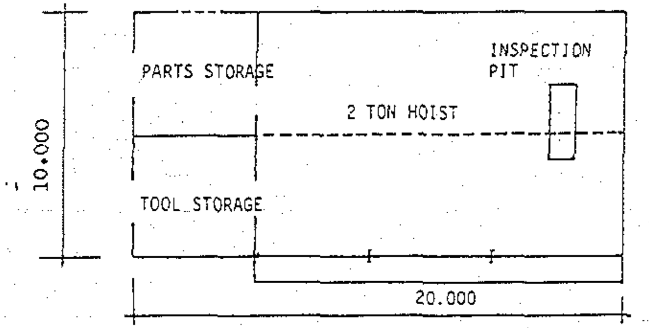
THE TRIAL PLANTATION PROJECT IN BENAKAT, SOUTH SUMATRA





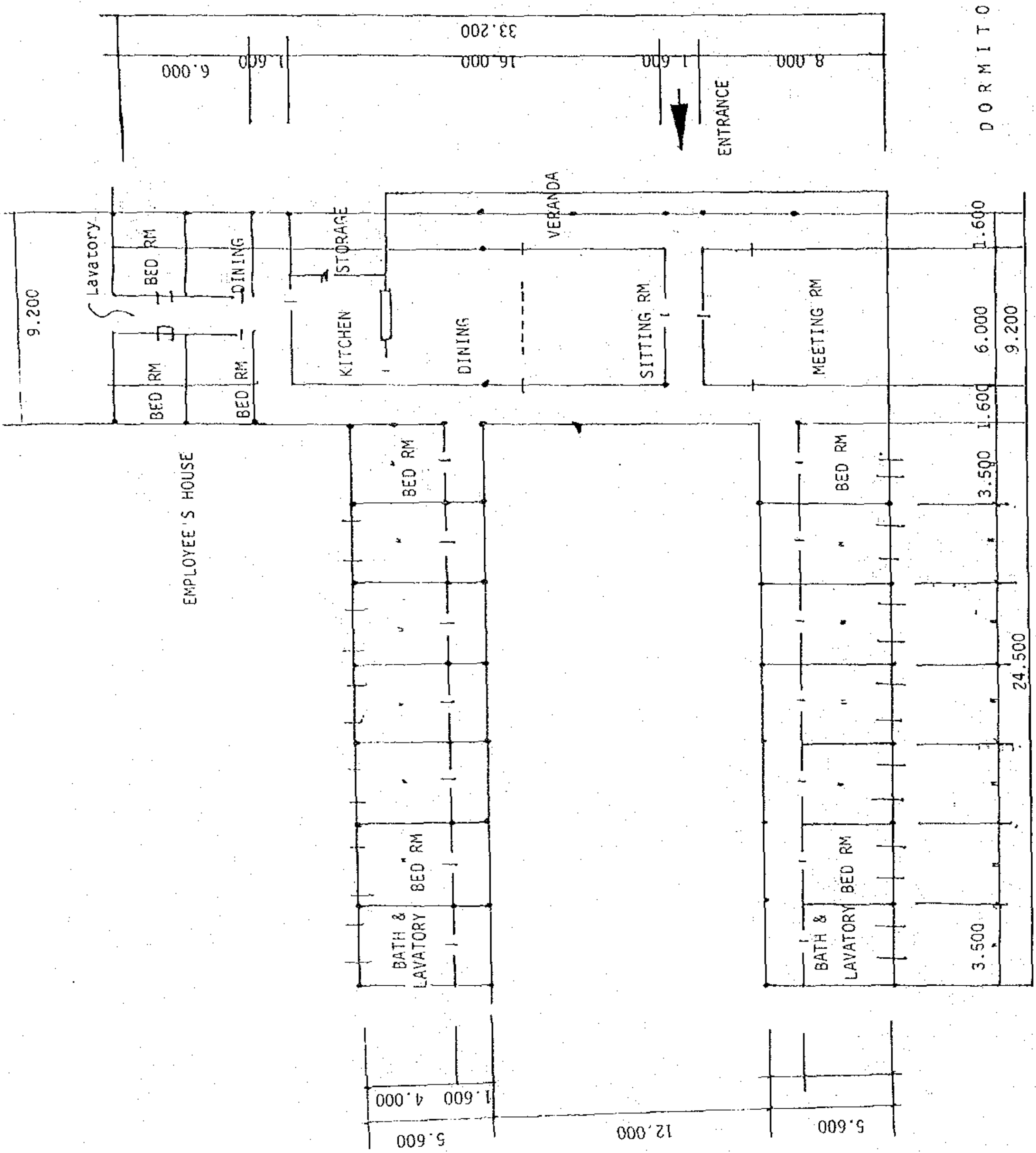
PLOT PLAN S : 1/1000

REFORESTATION TRAINING CENTER



MACHINERY WORKSHOP S : 1/200
200 m2

DORMITORY 580 m2



Appendix 9.

MINUTES OF DISCUSSIONS BETWEEN THE JAPANESE CONSULTATION MISSION AND THE AUTHORITIES CONCERNED OF THE GOVERNMENT OF THE REPUBLIC OF INDONESIA ON THE IMPLEMENTATION OF THE PILOT INFRASTRUCTURE SCHEME IN THE TRIAL PLANTATION PROJECT IN BENAKAT, SOUTH SUMATRA.

The Japanese Consultation Mission (hereinafter referred to as " the Mission "), heade by Mr. Masato Furuya and organized by the Japan International Cooperation Agency (hereinafter referred to as "the JICA"), visited the Republic of Indonesia from June 25 to July 9, 1981, for the purpose of outlining the proposed pilot infrastructure scheme (hereinafter referred to as "the Scheme") established in the Trial Plantation Project in Benakat, South Sumatra, which is being implemented by Record of Discussions signed between the JICA and Directorate General of Forestry on April12,1979.

During its stay in the Republic of Indonesia, the Mission had a series of discussions and exchanged views with the Directorate General of Forestry on basic matters necessary for implementation of the Scheme.

As a result of discussion, the Directorate General of Forestry and the Mission recognized the importance and necessity of the Scheme and agreed to implement the Scheme according to herein general work plan under the cooperation of the implementing agencies of the two governments and to recommed the matters referred to in the attached general work plan to their respective governments.

Jakarta, July 6 , 1981

Signed

MR. MASATO FURUYA

Team Leader
The Japanese Consultation Mission.

Signed

IR. APANDI MANGUNDIKORO

Director
Directorate of Reforestation and Rehabilitation
Directorate General of Forestry.

THE GENERAL WORK PLAN ON
THE PILOT INFRASTRUCTURE SHCHEME IN
THE TRIAL PLANTATION PROJECT IN BENAKAT, SOUTH SUMATRA.

1. Purpose

The Trial Plantation Project in Benakat, South Sumatra aims at the development and improvement of afforestation techniques on tropical grasslands. For this purpose, new afforestation techniques are introduced and adjusted through trial plantation so as to fit into the conditions of the tropical grasslands. In order to promote a large scale afforestation in Indonesia in future, it is essential to involve local inhabitants in the process of afforestation so that established planttaion can be well protected and improved techniques spread widely in many localities.

The Pilot Infrastructure Scheme aims at carrying out agroforestry and prepare required infrastructure for a model plantation to encourage people's participation in afforestation exercise.

2. outline of the Pilot Infrastructure Scheme.

1) Proposed Project Area.

Inside the Trial Plantation Project (ATA - 186) area or its activity which has suitable geographical and topographical conditions.

2) Components of Infrastructure

Necessary infrastructure such as forest roads, bridges, look-out towers and fire breaks will be constructed in the Project area.

3) Tree Species Introduced.

Tree species suitable for fire wood, charcoal, construction and furniture manufacturing will be planted. In addition, fruit trees or other agricultural crops will be introduced.

3. Measures to be taken by JICA

1) To bear expenses necessary for the following construction works.

   a. Forest roads
   b. Cultivation of project area
   c. Fire prevention facilities
   d. Bridges
   e. Other appurtenants works (including procurement of materials and equipment)

2) To dispatch short-term experts for basic design and supervision of construction works.

4. Measures to be taken by Directorate General of Forestry.

1) To make necessary lands available for the Scheme
2) To bear all expenses necessary for the establishment of plantations for the following works other than those carried out by JICA.

   a. Production of seedlings
   b. Site preparation
   c. Planting
   d. Tending
   e. Fertilization and supply of fertilizers.

3) To make necessary arrangements for the participation of local inhabitants in the Project area with full understanding of and cooperation with the Scheme.

4) Other related activities.

PILOT INFRASTRUCTURE PROGRAM IN BENAKAT.

I BACKGROUND

Large part of the " Peneplain " of South Sumatra is now covered with alang-alang grassland, but in many cases there flourished the dense tropical forest only several decades ago. The most important couse of such a drastic destruction was the repeated slash and burn by the subsistance farmers. Under the ever-increasing population pressure a vast forested area is still now being converted into the unproductive grassland.

Realizing the need for rehabiliting the devastated land, the Directorate General of Forestry (DGF) has developed the afforestation techniques such as " Jalur " (line planting) system, "Cemplongan (spot planting) " system and " Corridor " system. Needless to say, the core of the problem is socio economic one as well as technological new afforestation techniques must be combined with new organizational frame work, especially for the local people involvement.

In this connection, "agro-forestry" scheme has been proposed and practised successfully in many tropical countries. The "Prosperity Approach" of the Perum Perhutani is an excellent example. Here in South Sumatra, however, such a system has not been introduced so far, and the establishment of the suitable agro-forestry system is of urgent necessity.

II PROGRAM OBJECTIVES

The said Program, possibly the first attemp of agro-forestry in the outside of Java, has the practical objective to develop, test, demonstrate and extend improved "agro-forestry" practises.

The expected effects of the Program are as follows :

1) Reasonable combination of food crops and tree serves to maintain high productivity of the forest land because it is ecologically-sound in many tropical soils.

2) A carefully planned agro-forestry system enables the local people to obtain both agricultural crops and wages from the forestry activities, resulting in the improvement of their living standards.

3) For the DGF, the introduction of agro-forestry is to serve establishing and protecting forests through preventing farmers from uncontrolled slash and burn, making a good relation with the local people, and providing the required forestry labor force.

The Program will be carried out as a part of the Indonesia - Japan Trial Plantation which is now going on in the Benakat area aiming at improving mechanized afforestation techniques. In this program the necessary infrastructure to conduct the agro-forestry practises will be provided and the past two-year experiences of the current Trial Project will be fully applied.

III. PROGRAM OUTLINE.

The major components of the Program are demonstration area, and the intercropping plantation area. The required infrastructures will be provided.

i) Demonstration area: Various crops
Suitable for agrO-forestry are planted for demonstration and trial purpose.
They include; timber trees, fruit, nut, and fodder trees, agricultural food crops, grasses.
It is hoped to introduce other possible agro-forestry practises including sericulture, bee keeping, mushroom, etc, in the future.

ii) Intecropping plantation area: Farmers are invited to carry out " Tumpangsari" on an operational scale.

IV. PROGRAM DESIGN

1. Project Site
The proposed site is located in the National Forest Land in the south west of the Benakat Village as shown in the annex map 1.

2. Size of Project area.

Total area is 435 ha consisting of 38 ha of the demonstration area including road, fire break and facility site, 305 ha of the intercropping plantation area and 92 ha of the "Corridor" fire break. The layout of the project area is shown in the annex map 2.

3. Demonstration area.

In the central part the demonstration area (38 ha) will be established along with some necessary facilities such as road, fire break, a lookout tower, ponds, and buildings.

The area is devided into three parts; tree garden, fodder plant area and agricultural crop trial area.

1) Tree garden

The species in the annex table 1 are presently proposed as the candidates for the tree garden.

2) Fodder plant area

A trial introduction of some kinds of fodder plant is planned in order to prevent the farmers from burning alang-alang for grazing and increase their cash income by the intensive cattle raising.

3) Agricultural crop area.

The trial of food crops is planned using a relatively small acreage to demonstrate and test improved intercropping production. The proposed demonstration are

(1) fertilizing test

(2) variety trial for paddy, maize, peanut, etc,

(3) introduction of soy bean (7 varieties) mung bean (3 varieties), etc.

4) Facilities

The following infrastructure will be provided.

i) road including access, trunk and working road,

ii) fire break in the outer boader of the demonstration area by planting _Anacardium occidentale_ with cover crop,

iii) other fire control facilities; 2 ponds, a lookout tower and a set of fire extinguish equipments,

iv) buildings; an office with officer's residence (100 m2), a warehouse (200 m2) and a working and meeting house (300 m2).

5) Sharing of the expenses

i) JICA bears all expenses needed for establishing the demonstration area and its related facilities (the detail is shown in the annex table 2).

ii) DGF bears all expenses needed for managong and maintaining the demonstration area and the related facilities in and after the second year.

4. Intercropping plantation area.

1) Number of the participant families Thirty families will be selected among the applicants mainly residing in the Benakat area. The participants will be selected by the DGF.

2) Allotment

Every family is allocated 1 ha of plowed lot every year, and the land to be required for 10 years (30 family x 1 ha x 10 years = 300 ha) will be provided in the project site.

3) Planting trees

Every family must plant Albizia falcataria in the allocated lot in accordance with the contract between the farmers and DGF (an example of such agreements shown in the annex form of contract of labour. The allocated lot will be turned over to the DGF three years after planting tree seedlings.

4) Growing agricultural crops

The participants are allowed to plant annual agricultural-

-crops in between rows for two years after planting trees on the conditions of the contract.

5) Infrastructures

i) Base camp.

Every family is allowed to use a temporary house (30 m2) and its surrounding yard (400 m2) for growing annual food crops.

ii) Working road network (see the annex map 2)

iii) The "Corridor" will be established surrounding the whole area and along the working road, and concrete poles set up in the border as the land mark.

6) Sharing of the expenses.

i) JICA bears all expenses for (1) mechanized plowing in the first year and working road required in the first and second year and (2) the materials for the temporary houses (see the annex table 2).

ii) DGF bears all expenses for (1) establishing plantation except for plowing in the first year (2) establishing the "Corridor" around the boader and along the working road (3) contructing working road necessary in and after the third year, and (4) construction cost for the temporary houses except the materials.

Note 1. Selection of the participants

It is recommendation that some leading farmers should be selected to organize the participants farmers considering the regional balance among the sub-villages. Moreover, it is advised to set up a cooperative body for promoting collective operations by the farmers.

Note 2. Plantation cost

The intercropping plantation should be established at the standard cost (Rp. 349,000/ha) for the afforestation with mechanized over all plowing. The additional incentives such as crop seeds and fertilizer will not be given.

The total cost should be devided into the following three categories according to the body responsible for the operation.

i) Contractor;
Land clearing, mechanized cultivation and construction of working road.

ii) DGF;
suuply of seedlings and fertilizer

iii) Individual farmer;
planting, fertilizing and weeding.

The payment to the individual participants should be done in such a manner as shown in the example form of the contract.

EXPENSES FOR PILOT INFRASTRUCTURE SCHEME BORNE BY DGF

KIND OF WORK	COST/UNIT (Rp.1)	82/83 - 83/84		84/85 - 91/92	
		QUANTITY	EXPENSE (Rp)	QUANTITY	EXPENSE (Rp)
MANAGEMENT OF THE DEMONSTRATION AREA (FERTILIZATION, TENDING, TEST, ETC)	170,000/Ha	30.2 Ha x 1yr. (83/84)	5,134,000	30.2Ha x 8yrs.	41,072,000
MAINTENANCE OF THE INFRASTRUCTURE	3,000,000	1 yr. (83/84)	3,000,000	8 yrs.	24,000,000
ESTABLISHMENT OF THE CORRIDOR FIRE BREAK	349,000/Ha	92.2 Ha (82/83)	32,177,800	-	-
ESTABLISHMENT OF PLANTATION IN THE INTERCROPPING AREA (EXCEPT PLOWING IN THE FIRST YEAR)	349,000/Ha	30 Ha x 2 yrs (82/83-83/84)	15,674,400	30 Ha x 8 yrs.	83,760,000
CONSTRUCTION OF WORKING ROAD	2,476,000/km	-	-	0,65km x 8 yrs.	12,875,200
CONSTRUCTION OF TEMPORARY HOUSES	-	30 m2 x 30	6,000,000	-	-
T O T A L	-	-	61,986,200	-	161,707,200

TABLE 1. CANDIDATES OF TREE SPECIES FOR THE DEMONSTRATION AREA.

TIMBER AND FUEL TREE SPECIES

Albizzia falcata, Eucalytus deglupta, Anthocephalus cadamba, Acacia auriculiformis, Schima bancana, Pinus merkusii, Switenia macrophylla, Peronema canescens, Aleurites moluccane, Eusideroxylon zwageri, Shorea sp. , Hopea sp,. Octomelis sumatrana, Albizia lebbek, Prospis spp., Calliandra calothyrsus, Leucaena glauca.

OTHER USEFUL TREE SPECIES

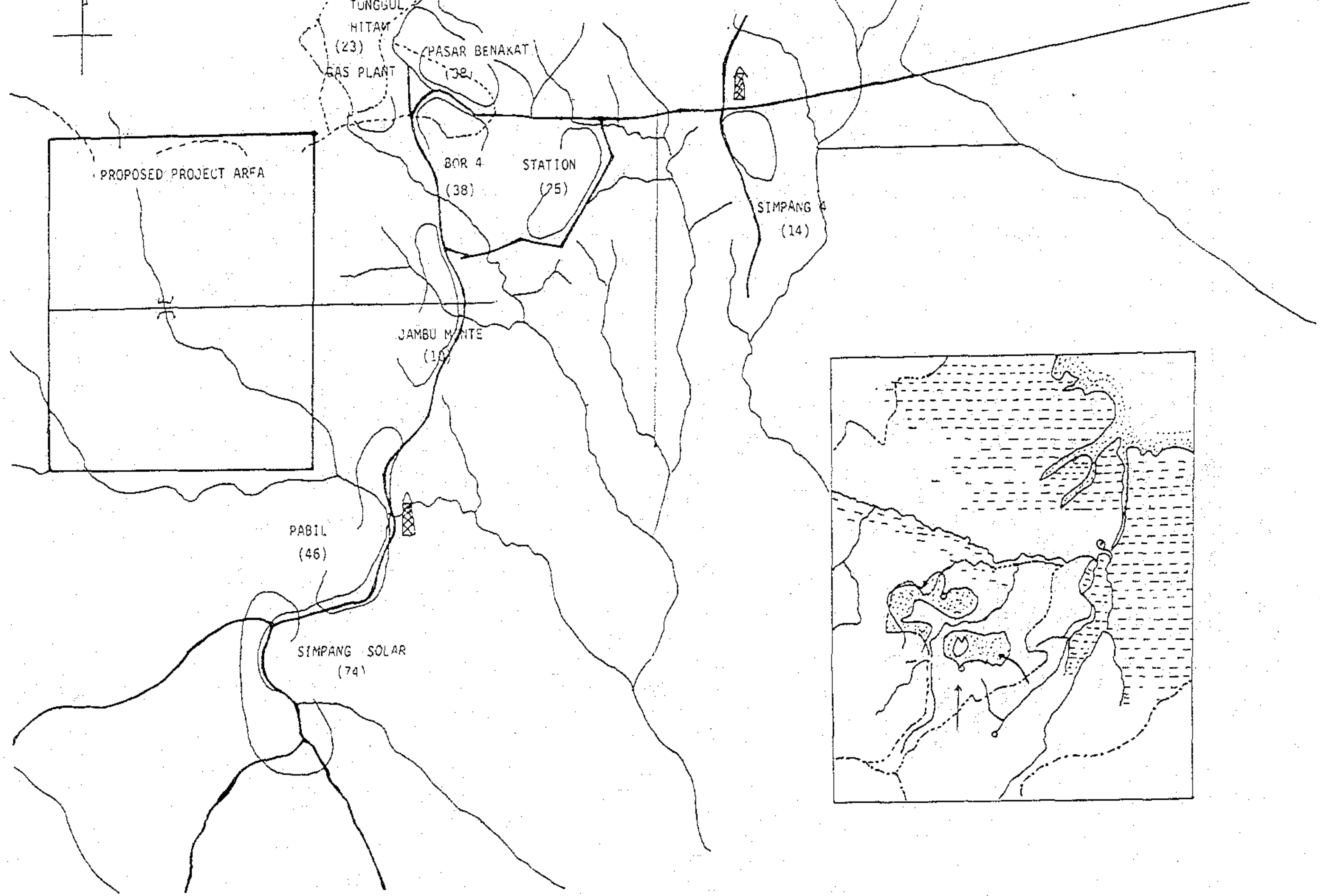
Artocarpus incisa, A. integer, A. heterophyllus, A. rigida, Castanopsis inermis, Annona squamosa, Persea americana, Inocarpus edulis, Averrhoa carambola, Citrus aurantifolia, Canarium album, C. commune, Lansium domesticum, Sandoricum nervosum, Baccaurea matleyana, B. malayana, B. racemosa, Mangifera indica, Styrax benzoin, Aquilaria microcarpa, Eugenia aromatica, Cananga odorata, Myristica fragrans, Michelia champaca, M. alba, Malaleuca leucadendron, Dyera costulata, Palaquium gutta, Aleurites molucana, Palaquium burkii, Elaeis guineensis, Cocos nucifera, Ceiba pentandra, Metroxylon sagus, Arenga pinnata, Metroxylon foetida, M. caesia, Dracontomelum mangiferum, Anacardium occidentale, Nephelium lappaceum, N. malaiense, Nephelium mutabile, Zyziphus mauritiana, Dillenia indica, Durio zibethinus, Garcinia mangostana, Flacourtia jangomas, F. inermis, F. rukam, Eugenia jambos, E. malaccensis, E. javanica, Achras zapota, Areca catechu, Coffea arabica, Theobroma cacao.

TABLE : THE BUDGET FOR THE INFRASTRUCTURE PROGRAM BORNE BY JICA

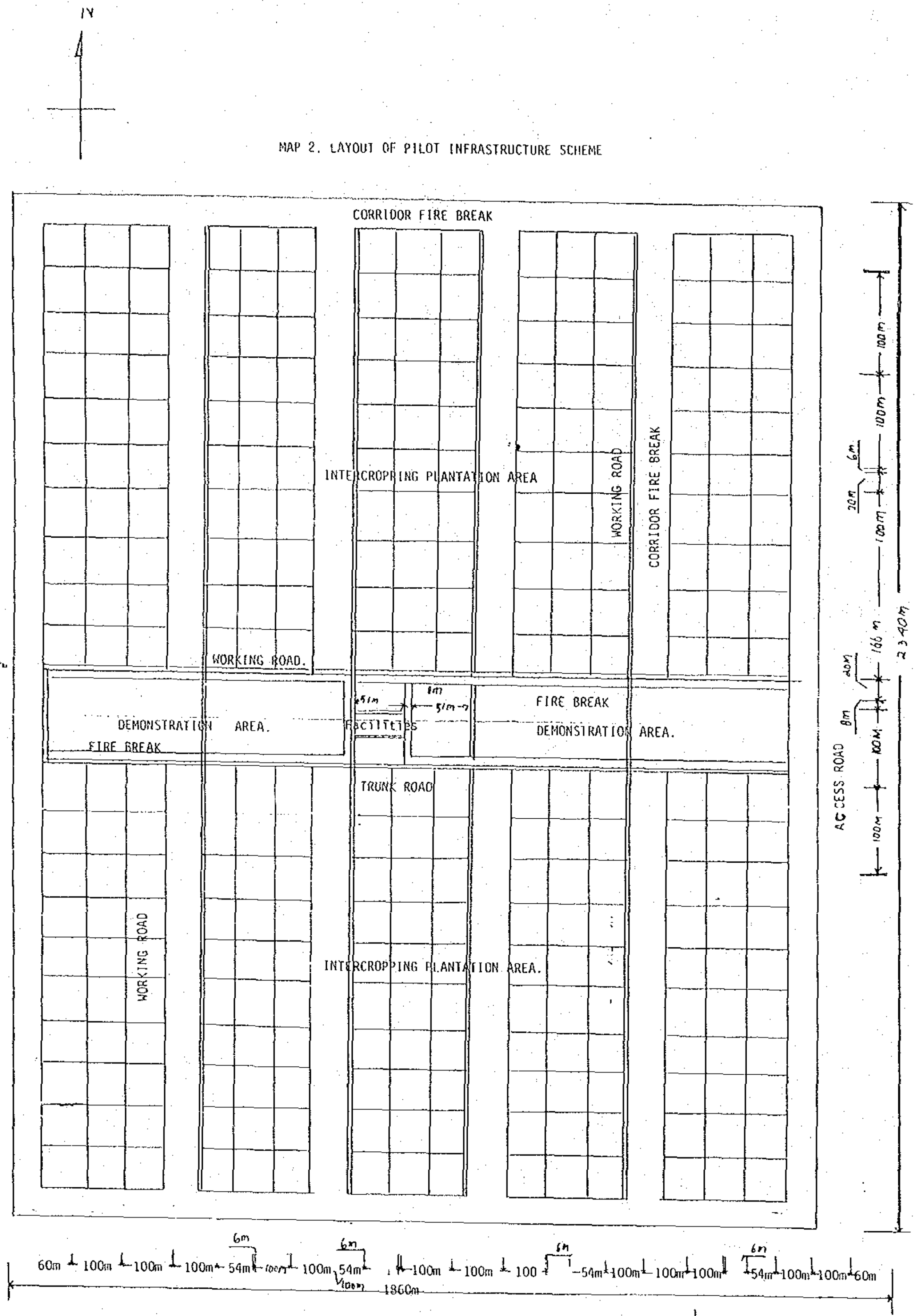
KIND OF WORK	QUANTITY	EXPENSE (RUPIAH)	REMARK
ACCES ROAD		5,710,400	
ROAD	800 m		
GRAVEL	240 m3		
TRUNK FOREST ROAD		21,386,936	
ROAD	2.152 m		
UNDER DRAIN WORK	56 m		
BRIDGE	1		Ø - 1.00
GRAVEL	360 m3		L - 12.00
WORKING ROAD		16.089,224	
ROAD	4.772 m		
UNDER DRAIN WORK	36		Ø - 1.00
BRIDGE	1		L - 12.00
CULTIVATION		9.146.400	
INTERCROPPING			
PLANTATION AREA	30 ha		
DEMONSTRATION AREA	26,4 ha		
BULLDOZER	24 ha		
FIRE CONTROL FACILITY		10.295,600	
LOOK OUT TOWER	1		
POND	2		4961 m3
FIRE BREAK	7 ha		
FIRE EXTINGUISH EQUIPMENT	1 set		
DEMONSTRATION AREA		62,032,620	
SITE PREPARATION FOR FACILITIES.	1,82 ha		
CONTROL OFFICE	100 m2		
WAREHOUSE	200 m2		
WORKING & MEETING HOUSE	300 m2		
CONCRETE TANK	1 set		include a toilet house

EQUIPMENTS	1 set	
HANDTOOLS	1 set	
ESTABLISHMENT OF PLANTATION	1 set	
MATERIALS FOR TEMPORARY HOUSES	1 set	
INDIRECT EXPENSES		25,338,821
T O T A L		150,000,000

MAP I. LOCATION OF THE PROJECT.



MAP 2. LAYOUT OF PILOT INFRASTRUCTURE SCHEME



CONTRACT OF LABOR

FOR THE : REFORESTATION IN THE AGRO-FORESTRY PROGRAM, BENAKAT, SOUTH SUMATRA.

KNOW ALL MEN BY THESE PRESENT :

This contract of labor, entered into by and between ______________________, Indonesian, aged ___________ and residing at ______________________________, Indonesia, hereinafter refferred to as the Party of the First Part, and the Directorate General of Forestry (DGF) , a government entity, represented herein by ____________________, also a Indonesian residing at ________________________, Indonesia, and hereinafter referred to as the Party of the Second Part.

WITNESSETH :

WHEREAS, the Agro-forestry Program by DGF is implemented in order to involve the local inhabitants in afforestation. Each family will be allotted 1 hectare for planting trees and maintain the lot for 3 years until the area is turned over to the DGF.

NOW, THEREFORE, for and in consideration of the foregoing premises, the parties herein agreed, as they hereby agree, on the following terms and condtions, to wit :

A. The Party of the First Part (Family) :

1. The Party of the First Part must __________
   - a) be interested and willing to participate ;
   - b) be willing to undergo planting, maintenance and other forest renewal activities.

2. Plant the 1 hectare - lot allotted in accordance with the following condtions. :
   - a) prepare the site for planting (dig holes) ;
   - b) plant and fertilize the seedlings planted at a distance of 4 meters by 2 meters ;
   - c) weeding must be undertaken regularly for 3 years (2 times in the 1 st year, 2 times in the 2 nd year and 2 times in -

-the 3 rd year) ; and

d) maintain and protect the trees until the area is turned over to the DGF.

3. Be responsible for the damage caused by fire which started within his plantation.

4. Planting of agricultural crops in between rows shall be allowed in accordance with the following guidelines.

   a) agricultural cropping is allowed for 2 year after planting trees ;
   b) agricultural crop must be planted 0,5 meter at least a part from the host trees ;
   c) the perenial crops, cassava and climers without suppoting sticks are prohibited.

5. Each family is allowed to use a temporary house and to grow annual crops including banana and papaya in its surrounding yard until the termination of this contract.

B. Party of the Second Part :

   1. The DGF shall manage this Program and shall train the Party of the First Part in the proper procedures of planting and maintenance.

   2. Subdivide the plantation area and allot 1 hectare lot to the Party of the First Part by draw lots.

   3. Cultivate the plantation area by tractors before alloting the lot to the Party of the First Part.

   4. Provide tree seedlings, fertilizer and technical assistance to the Party of the First Part.

   5. Pay in anstallment the Party of the First Part after completion of every major activity.

The first payment shall be given after planting.
The activities involved in planting operations are digging of holes, planting and fertilization. The payment will be Rp. 8.000,- per hectare.

Second payment shall be paid after the first weeding (3 months after planting), and fertilization after an inventory has been conducted by a representative of the government and the family. Payment will be done at Rp. 20.000,- per hectare only when survival more than 90% is attained.

Third anstallment shall be paid after secong weeding (6 months after planting) and replanting. Seedling for replanting shall be provided by the government. Payment shall be Rp. 20.000,- per hectare for a survival rate higher than 90 %.

Forth payment shall be given after the third weeding (12 months after planting). Payment will be Rp. 16.000,- per hectare for a survival rate higher than 90 %.

Fifth payment will be paid after the forth weeding (18 months after planting). Payment will be Rp. 16.000,- per hectare for a survival rate higher than 90 %.

Sixth installment will be given after the fifth weeding (24 ,onths after planting). Payment will be Rp. 16.000,- per hectare for a survival rate higher than 90 %.

Seventh payment shall be paid after the sixth weeding (30 months after planting). Payment will be Rp. 16.000,- per hectare for a survival rate higher than 90 %.

Final payment shall be given after the seventh weeding, protection and maintenance of seedlings planted and after an inventory has been undertaken. Payment shall be Rp. 38.000,- per hectare for a survival rate higher than 90 %.

All improvements introduced in the area by the Party of the First Part shall be transferred to the Party of the Second Part after three years and upon completion of all activities.

This contract shall be declared null and void by the Party of the Second Part for failure of the Party of the First Party to comply with the conditions herein set forth, as follows :

a) If the area subject of this contract was used for other purposes than that stipulated herein : or

b) Violation or non-complience to the conditions herein set forth.

Any condition or objective as agreed upon by both parties be considere-red part of this contract.

This Contract shall take effect upon signing by both parties.

Signed this __________ day of ________________, 19 _____ 1t

______________________________, Indonesia.

______________________________ ______________________________

Head of Family
Party of the First Part.

Party of the Second Part.

CONFORME

____

Wife

APPROVED :

____

Regional Director DGF

SUPPLEMENT DOCUMENT
THE PILOT INFRASTRUCTURE SCHEME IN THE TRIAL PLANTATION PROJECT IN BENAKAT, SOUTH SUMATRA.

1. PURPOSE

The Trial Plantation Project in Benakat, South Sumatra aims at the development and improvement of afforestation techniques on tropical grasslands. For this purpose, new afforestation techniques are introduced and adjusted through trial plantation so as to fit into the conditions of the tropical grasslands. In order to promote a large scale afforestation in Indonesia in future, it is essential to involve local inhabitants in the process of afforestation so that established plantations can be well protected and improved techniques spread widely in many localties.

The Pilot Infrastructure Scheme aims at carrying out agroforestry and prepare required infrastructure for a demonstration area to encourage people's participation in afforestation exercise.

2. OUTLINE OF THE PILOT INFRASTRUCTURE SCHEME.

1) Proposed project area.
The proposed site is located in the National Forest Land in the south west of the Benakat Village as shown in the annex map 1.(map and table are same as Appendix 10). Total area is 435 ha consisting of 38 ha of the demonstration area including road, fire break and facility site, 305 ha of the intercropping plantation area including working road, and 92 ha of the " Corridor " fire break. The layout of the project area is shown in the annex map 2. (map and table are same as Appendix-10).

2. Components of infrastructure.
Necessary infrastructure such as forest road, bridges, fire control facilities, buildin-s, fire breaks and the " Corridor " will be constructed in the project area.

3) Tree species to be introduced.
The tree species in the annex table 1 (map and table are same as Appendix 10), are presently proposed as the candidates.

3. MEASURES TO BE TAKEN BY JAPAN INTERNATIONAL COOPERATION AGENCY (JICA).

1) Sharing of the expenses.
JICA bears all expenses needed for the following construction works (the details are shown in the annex table 2).

a. Forest roads and bridges
b. Cultivation for the intercropping plantation in the first year
c. Fire control facilities
d. Establishment of demonstration area
e. Other appurtenant works (including procurement of materials and equipments).

2) Dispatch of short-term experts.
JICA will dispatch short-term experts for basic design and supervision of construction works.

4. MEASURES TO BE TAKEN BY DIRECTOARTE GENERAL OF FORESTRY (DGF)

1) Necessary land for the scheme.
DGF make necessary land available for the scheme

2) Sharing of the expenses.
DGF bears all expenses necessary for the establishment of plantations for the following works other than those carried out by JICA.

a. Productions of seedlings for the plantation of 30 ha x 10 years ('82/84 - '91/92).

b. Cultivation for the planting area of 30 x 9 years ('83/84 - '91/92).

c. Planting and tending for the plantation of 30 ha x 10 years ('82/83 - '91/92)

d. Management of the demonstration area ('83/84 - '91/92).

e. Maintenance of the infrastructure ('83/84 - '91/92).

f. Establishment of the " Corridor " ('82/83).

g. Construction of working roads of 0.8 km x 8 years ('84/85 -'91/92)

h. Construction of the temporary houses except the materials ('81/83).

3) Arrangements for the participation of families.
DGF makes necessary arrangements for the participation of local inhabitants in the intercropping plantation area with full understanding of and cooperation with the scheme.

4) Other related activities.

FINAL REPORT
OF
THE TECHNICAL COOPERATION FOR THE TRIAL PLANTATION PROJECT/ATA - 186
IN
BENAKAT, SOUTH SUMATRA

1 NOVEMBER 1981.

KATSUYUKI OHMI
TEAM LEADER, SILVICULTURE EXPERT
JAPAN INTERNATIONAL COOPERATION AGENCY.

Transmittal Letter

Dear Sirs,

My term of duty on the Trial Plantation Project / ATA-186 (TPP) will terminate in November.
Before my departure for home, I wish to submit herewith a very brief report on the TPP my counterparts and I have carried out the past two years.

Two years of my stay was a short period in my life but it was one of the most pleasant and useful experience for me. I would like to this opprtunily to express my most sincere gratitude to the Indonesian counterpart and Japanese experts as well as to those who participated in this project for their undivided cooperation. Without them the TPP would not have been possible. And if I have accomplished anything in this project, the credit is theirs.

Wishing an everlasting prosperity for the TPP and hope you continue your dedication to develop your country's afforestation and reforestation.

Respectifully yours,

Katsuyuki OHMI
Team Leader , Expert
Japan International
Cooperation Agency

I. INTRODUCTION

1.1. We have cooperated with each other in implementing the Project for the purpose of establishing afforestation techniques so as to contribute to successful afforestation in the grassland in South Sumatra.

1.2. In accordance with the Record of Discussion signed on the 12th April 1979 and Plan of Operation decided on the 30th October 1980 (The Second-Joint Steering Group) I have promoted the following items

(a) making working plan;

(b) calculation necessary expense for project implementation;

(c) setting up organization for activities of each fields;

(d) buildings, vehicles and equipment for project implementation and operation;

(e) consulting services to accept Japanese Experts, to select a Kind of provision machine and to dispatch trainess to Japan; and

(f) technical advice and guidance for activities of each fields.

II. NURSERY ACTIVITY

2.1. Nursery section have been realized:

(a) land preparation : 2 hectare
(b) fixed nursery with the watering system : 1 hectare
(c) construction of fixed bed : 108 brick beds & 350 wooden beds.
(d) construction of cuuting shed (50m2) and germination shed (6 sheds, total floor space : 72 m2)
(e) out planting number : 400,000 seedlings
(f) training of nursery machine (water pump, tractor, fork-lift, conveyor with engine, soil heater, soil screener, tiller, seed stocker, trencher, cutter, generator, bush cutter, experimental tools).

(g) experiment of nursery(seed testing, germination testing, seedling growth survey, cutting test)

2.2. 800.000 sedlings production is going on and nursery experiment is conducted.

2.3. From now, nursery activities should be improved and developed.

(a) the most suitable potting media on a wide view point
(b) mass production system of soil potting
(c) seed collecting and storing method.

III. PLANTATION ACTIVITY

3.1. We have carried out as follows;

(a) planting : 200 hectare (4 species, 50 hectare a species)
(b) establishment of fixed plots (A1 compartment, A2 compartment)
(c) construction of one working houae and heavy duty machine store shed.
(d) weeding 2 times every compartment.
(e) survey survival rate :

- survival percentage at two months after planting

A 1	A. falctaria	87 %
A 2	S. macrophylla	90 %
A 3	E. urophylla	76 %
A 4	P. merkusii	93 %

- residual tree percentage after second weeding is 87%, 89%, 67% and 52% respectively.

3.2. Measurement survey, construction working house, site preparation of mechanization system and manual system, and observation of fixed plot are in progress.

The following experiment items will be done based on Annual Working Plan in 1981/1982.

(a) study on fertilizing ;
(b) study on weeding ;
(c) combination study between fertilizing and weeding ;
(d) study on herbicide ;
(e) study on site preparation ; and
(f) study on soil improving tree

3.3. Plantation section should be taken the following treatment to improve plantation activities ;

(a) to bring up a good worker group, accordingly, it as necessary to introduce a proper training for plantation workers, especially, weeding worker by bush cutter ;

(b) to take a suitable wage system which stimulates labour conscience ;

(c) to make a planting hole considering soil condition and seedling condition ;.

III. FOREST ENGINEERING ACTIVITIES.

3.1. Forest engineering section has carried out to constract and maintain 20 km., forest road. And this section has done the training for vehicle drivers, heavy duty machine operators, generator operator, other machine with engine operator and mechanicians.

3.2. This section is mainly going on the maintenance for machine and road, and the training for drivers, operators and mechanicians.

3.3. Forest engineering activities will be done the following items :
(a) comparative study of the road surface working method ; and
(b) employment of good drivers, operators and mechanicians due to a suitable salary system.

IV. FOREST PROTECTION ACTIVITIES.

4.1. This section has accomplished to construct green fire belt 4,500 m, yellow fire belt 500 m, and the site preparation 40 hectare for fire belt. Patrol against fire, insect, disease and meteorological damage in plantation area have been done.

4.2. Tending of fire belt and patrol are in progress.

4.3. This section should attach importance to the following items ;

(a) to select a suitable tree and cover-crop for fire belt ; and

(b) to establish a cooperation organization which is organized by rural community, when forest will be suffer from a fire.

Appendix 13

Work Report
"Proposal at Mechanized Afforestation"
Yoshiichi Sakamoto
Liaison Officer
Trial Plantation Project in South Sumatra
Period dispatched: Dec. 17, 1979 - Dec. 16, 1981

Introduction

What I am going to state is my opinions and impressions based on my two years of experience in the Trial Plantation Project in South Sumatra and is not authorized. It may contain technical and theroretical contradictions but I believe that people will at least understand the general idea of my contention.

It is, indeed, some time before the local afforestation can be mechanized. So, it is absolutely necessary to have a sound outlook of how to achieve it.

1. Motive of this project mechanization

Generally, mechanization is realized in the following cases:

i. If mechanized work cost is smaller than labor cost.

ii. If absolute labor volume is insufficient.

iii. If mechanization is required by policy or some other strong will.

But the following problems often arise with mechanization in developing countries:

i. Mechanization causes the loss of opportunities of employment.

ii. Because of low wages, economy, which is the basic requirement of mechanization, is not necessarily more favorable for mechanized work than manual work.

iii. Mechanized work is not necessarily efficient because the correct notion of operation and repair of machines and the methods of their handling are not locally widespread.

iv. There are problems with the supply of parts and the employment of excellent mechanics in remote districts.

Notwithstanding that, the Trial Plantation Project is now proceeding with the development of a mechanized afforestation system for the following reasons:

a. Securing sufficient labor force for large-scale afforestation in the depopulated districts in the outside Jawa of Sumatra is considered to be impossible.

b. Pot seedling system consists mostly of the carrying and handling of heavy objects. In other words, it is not too much to say that it consists almost entirely of the carrying of soil. Further, mechanizing nurseries means the fixation of nuseries. With the yearly separation of plantations, the distance between nurseries and plantations for which pot seedlings are carried is destined to increase. Thus, mechanization is considered necessary from the position that properly the carrying of heavy objects is unsuitable for human labor.

c. It is considered that the economic disadvantage of mechanized work, as compared with manual work, can be ovecome by systematically introducing, improving and establishing mechanization.

d. From the increasingly important policy of securing resources, the short-term recovery of forests is expected of large grasslands in the outside Jawa. To realize this, the expansion of absolute implementation capacity is considered to be urgently necessary.

For the above reasons, efforts are being exerted to develop and advance mechanized afforestation.

This development and furtherance of mechanized afforestation may succeed or fail, depending largely on how to overcome the aforementioned problems relative to mechanization. I shall hereunder discuss and propose as to what should be done to further rationalize and improve the present system of mechanized afforestation.

2. To make mechanization a success ---

(1) Scope of mechanization

It seems that the scope of mechanization is, after all, determined by its relative difficulty. The more complex the work of each machine is, the more difficult the work is, both technically and economically. Work that is suitable for mechnaization is work that is quantitative and standard. It is, therefore, necessary for work to have been specialized, simplified and standardized. Work that is extremely detailed or requires judgment is unsuitable.

When one considers the flow series from the nursery to the plantation, one becomes aware of the necessity to divide work into two general groups: work types easy to mechanize and those that are not and thereby determine the scope of mechanization without impairing the overall efficiency of the mechanized system.

As stated already, pot planting consists mostly of the carrying of soil. The carrying of heavy objects should be mechanized as much as possible. The work of gathering, loading and unloading heavy objects should also be mechanized. Whereas, delicate work and work requiring judgment, such as the transplanting of young seedlings to pots and the selection of seedlings, apparently impair overall efficiency less if they are prevented from being fully automatic by allowing manual work to intervene. In view of the present technical level and the present capacity to bear enterprise cost, it is difficult, if not impossible, to devise, for example, an automatic machine necessary to transplant young seedlings into pots. It seems that if ways can be contrived whereby, even with the intervention of manual work, the overall flow of the mechanical system is not impaired and the velocity does not fall, the system stands all the more chances of realizati on and practical utilization.

Further, mechanization or automation does not necessarily mean introducing all these machines. On the contrary, automation can, for instance, be naturally accomplished by taking advantage of the energy that a heavy object at an elevation naturally has. For example, the process of shifting which links the series of processes: collection of pot soil at the nursery, mixing, filling of pots with soil, transplanting and nursing can be automated by arranging the processes from a height gradually down and causing self-movement by a simple chute or a rail rather than use a belt conveyor or a conveying machine.

Considering the conditions as a developing country and the conditions of forestry, the use of highly scientific and precise machines is rather out of place. It is necessary that any mechanization should be in accordance with local or natural conditions.

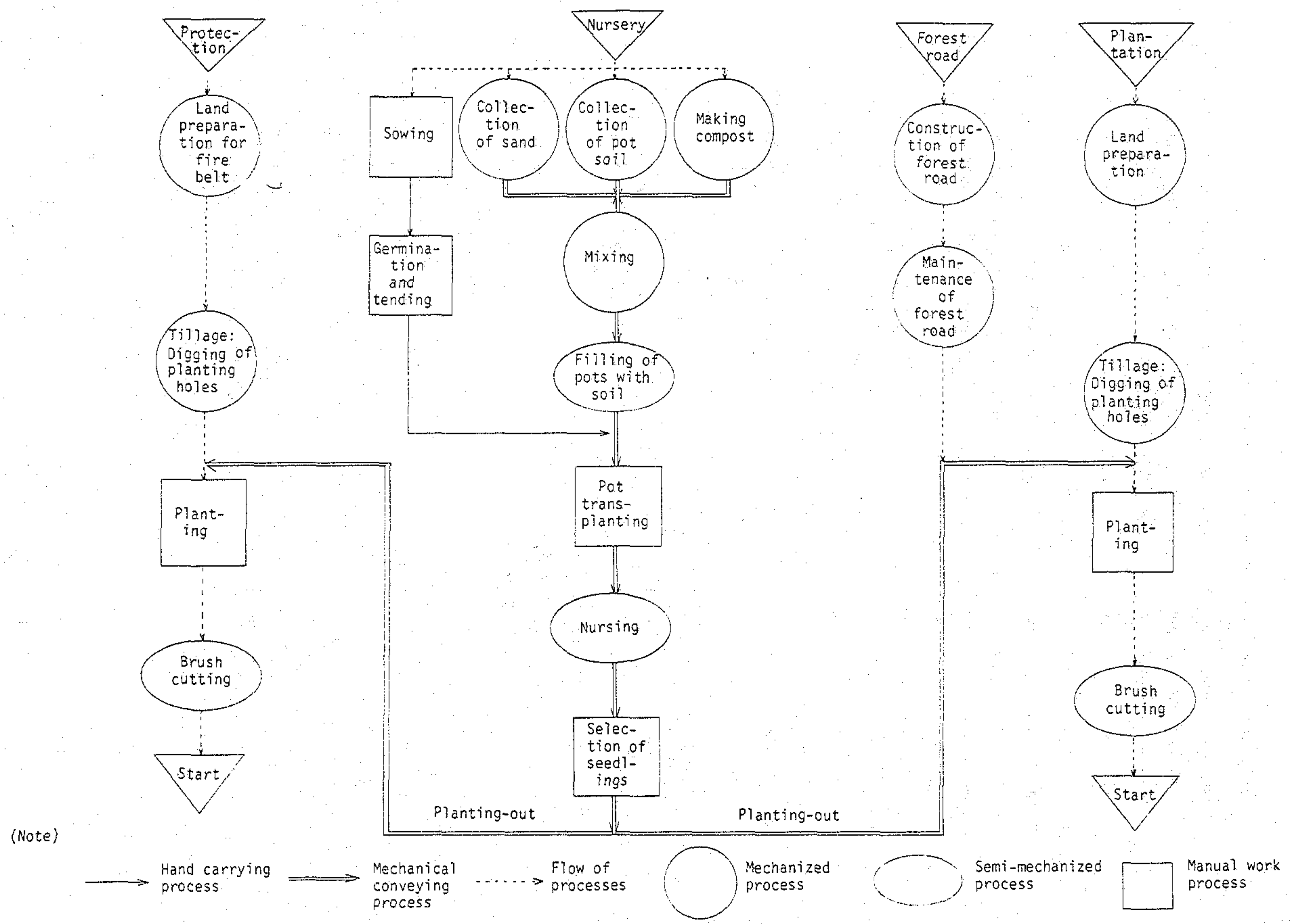


Fig. 1 Flow Chart of processes in Mechanized afforestation

3. Present and future of Mechanization under this project

(1) Flow of mechanized process

The flow of processes in mechanized afforestation is shown in Fig. 1. In it, the processes are divided into (i) processes that can be completely mechanized, (ii) completely manual work processes and (iii) and semi-mechanized processes halfway between (i) and (ii) and the conveying processes linking the various work processes are divided into mechanical conveying processes and hand carrying processes. These series of processes will be repeated every year.

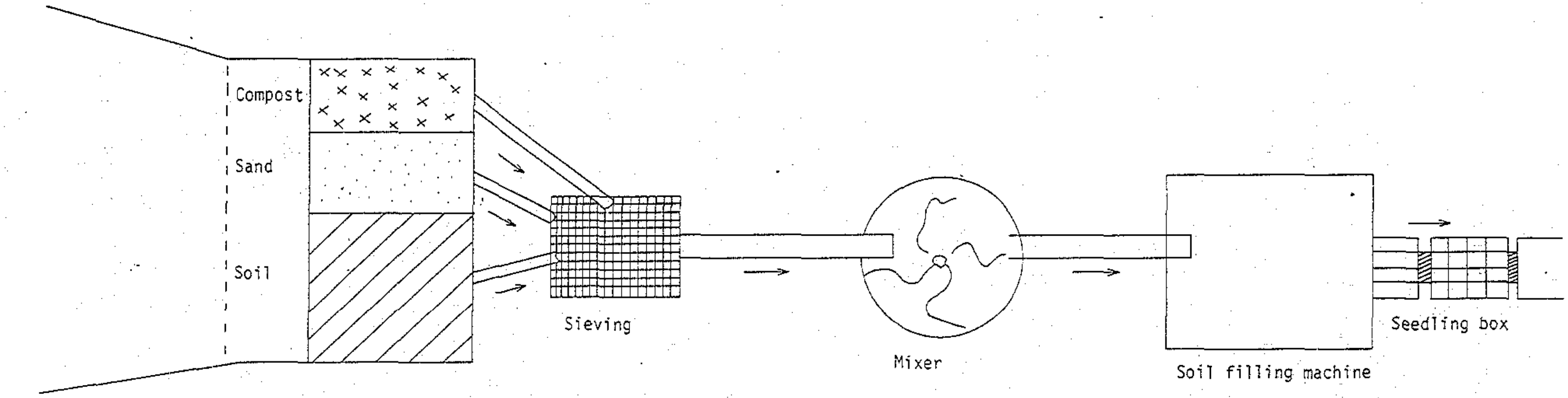
a. Hand carrying process

Manual work will be used for objects like young seedlings which are light and small and requiring delicate handling, because no merit of mechanization can be expected of it.

b. Mechanical conveying process

Dump trucks, cargo trucks, crane trucks, trailer trucks or belt conveyors are used for shifting heavy objects between different work processes. It can be seen from the whole picture of a mechanized afforestation project that conveyance represents the most part of the work. Soil, sand, compost and potted seedlings, which are the objectives, have large capacity and weight. What to select as conveying machines depends on the type that best matches the processes that precede and follow the conveyance and on the conditions of conveyance itself. Pot soil, for example, can be transported for a long distance and directly deposited into the hopper, which is the next process, if a dump truck is used. But to bring soil mixed here to the pot filling machine, which is the next process, a belt conveyor is more suitable since the same work ground is used for both processes and since continuous conveyance is required.

This is generally the manner in which work concerning conveyance is being implemented under this project. However, the unsatisfactory connection from conveyance to the next process must be improved. For example, soil that has been collected and brought by a dump truck is unloaded on level ground for once. So, it has to be loaded again onto a belt conveyor for screening and mixing.


Compost
Sand
Soil
Sieving
Mixer
Soil filling machine
Seedling box

Plan

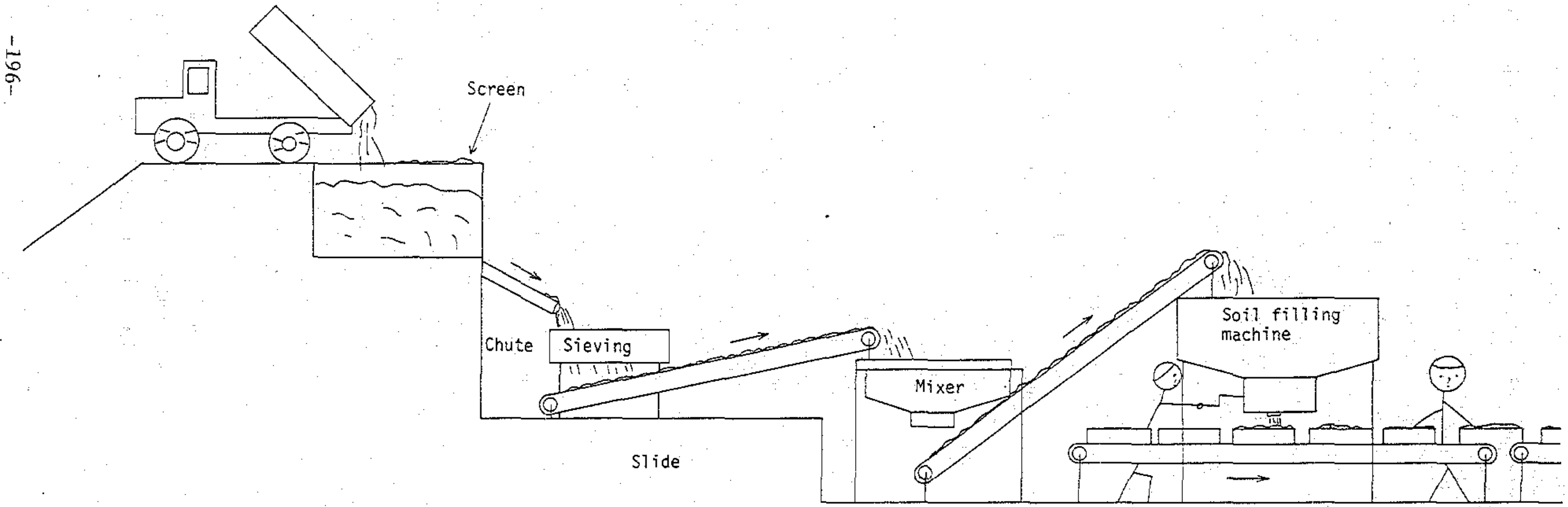

Screen
Chute
Sieving
Slide
Mixer
Soil filling
machine

Fig. 2

Something must be done to assure smooth flow from work to conveyance to work and dispense with manual work requiring physical strneghth for this flow as much as possible. To ensure efficient functioning as a system, it is important what should be done about this connection. Soil on a dump truck already has potential energy. If It is unloaded, that much energy is necessary to lift it again. If soil is not directly thrown into the hopper, which is the next process, it should be kept at the high position throughout. Moving something from a high position to a low place is easy and can be done by hand. So, soil that has been brought by a dump truck must be unloaded at an elevation -- an embankment or a platform. Conceptually, it is as indicated in Fig. 2.

Certainly, changing thus the work setup under the present project is not easy as it requires facility construction, civil engineering work, etc., but this system is necessary for the stabilized mass production of pot seedlings. And mass production alone can make work efficient and profitable.

c. Collection of sand

Sand is now bought on the basis of field delivery. It is unloaded also on level ground. It should be unloaded at an elevation, instead.

If sand can be taken from a river, digging and loading sand by a shovel-dozer may be possible but, since the crawler type, such as shovel-dozer, is unsuitable for long-distance movement, the wheel type should be used, instead, if the river is at a distance. If the distance is, indeed, great, trailer trucks will be necessary. Under this project, the necessity of wheel-type shovels and trailer trucks probably should be studied. Trailer trucks are necessary to bring heavy equipment to a repair shop, shift the worksite or bring new heavy equipment to the worksite. Also, highly mobile wheel-type shovels are useful for the transportation or loading of pot soil, sand and compost. Anyway, this is a process that can be easily mechanized.

d. Collection of pot soil

At present, pot soil is collected by the combination of shovel-dozer and dump truck. The problem is that, as stated, soil is not directly thrown into the hopper. Further, if the distance from the borrow pit to the nursery is great, the cycle time of dump trucks is long and the waiting time of shovel-dozers is also long. To improve the rate of operation of heavy equipment with high fixed cost bearing rates, it is necessary to reduce the idle time of machines. Thus, something must be done to eliminate their waiting time. Waiting time must be used to remove surface objects, excavate, collect soil and transport it. Also, it must be used to prepare an approach to bring dump trucks as close to the borrow pit as possible.

In the future, shovel-dozer must be replaced by highly mobile wheel-type shovels.

e. Making compost

Compost must be made more than six months in advance of the time it is required, because its maturing takes time. Making compost comprises many processes including the collection and transportation of grass, sprinkling, maturing, turning over and loading and making compost itself must have a system if compost is to be rationally mass-produced. Under this proejct, compost is produced on a small scale by the compromise between manual work and mechanical work, because some of the compost used is bought from the outside. In Japan, a staired compost barn has been devised and is in practical use. Facilities, such as this, may be locally necessary for the stabilized mass supply of compost. Its advantage is that the compost is turned as it is dropped from stair to stair according to degrees of maturation. This is an instance of utilizing potential energy.

Anyway, this is a process that may well be mechanized by using tractors and various attachments.

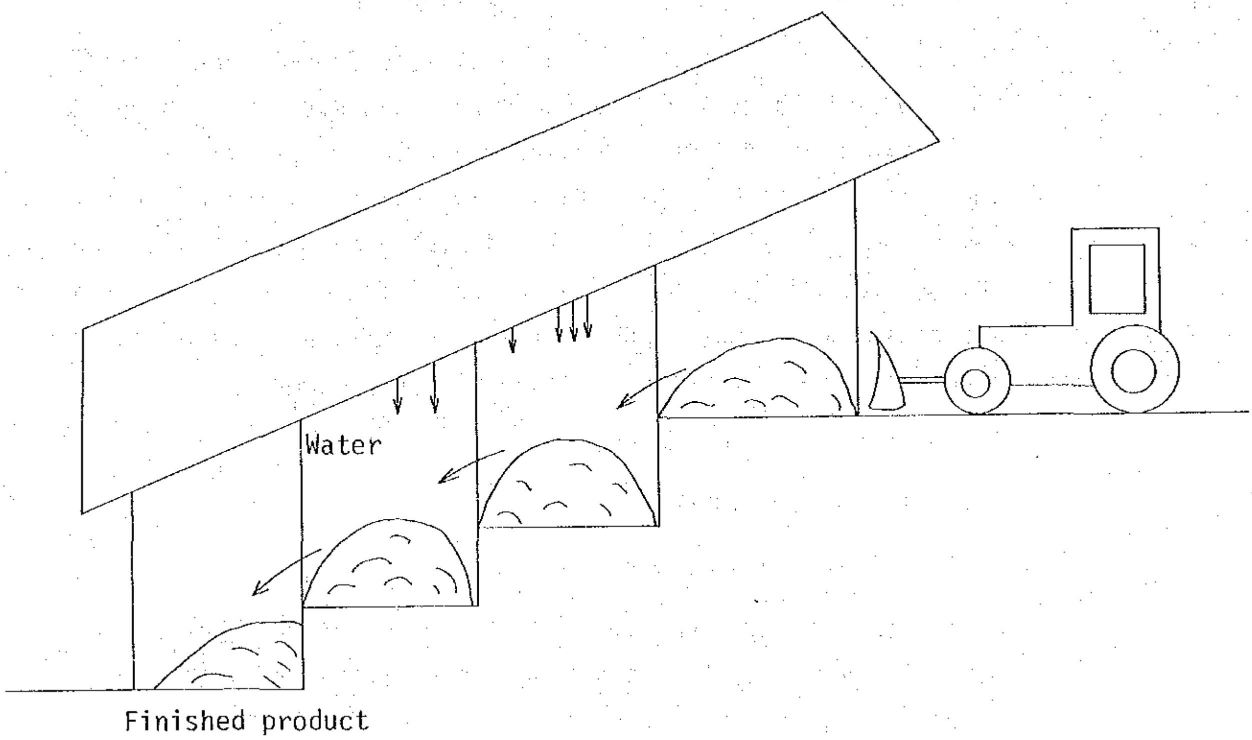


Fig. 3

f. Mixing

This consists of mixing soil, compost, sand and fertilizer by suitable quantities. Since the mixture is packed in containers of limited size, clods and admixtures beyond a certain size or length must be removed from soil and compost. For this purpose, the materials must be sieved before mixing. Fig. 2 shows what is believed to be a system that may well be realized for this project. In this case, there must be such contrivances as providing sluice valves so that soil, sand and compost can be chuted from the stock yard by suitable quantities. Constant flow cannot be maintained unless the stocks of soil, sand and compost, conveyor speed and the handling capacities of sieving machine and mixture are balanced. At present, a considerable volume of manual work is involved and, in some respects, the operation is none too smooth. Ensuring smooth flow for this operation is rather difficult but the best combination of machines and the best way to use it must be developed by trial and error.

g. Pot filling

This process is presently handled by manual work. Automating it is extremely difficult since vinyl pots are used. Also, there is no vinyl pot filling machine available for practical use. There is a filling machine for solid pots but it is not yet at the stage of practical use. It is also economically problematical because of the cost of solid pots. The following alternatives are conceivable as a means to mechanize this process which takes nearly a half of the labor volume of nursery work:

i. Developing a new method.

ii. Changing the system.

iii. Keeping up manual work.

As to "developing a new method", there are problems about the possibility of developing a highly scientific machine and its extension in view of the conditions of forestry and the cost bearing capacity, as stated already. So, let us discuss the method of "changing the system".

One notices from the overall picture of nursery work that individual pots are always treated as the minimum unit in all processes and that innumerable pots are basic to all work including transportation, nurturing, relocation, lifting and restacking. It seems that, in the future, the capacity to afforest the vast grasslands in the outside Jawa cannot be drastically improved unless the unit in the above treatment is expanded. So, I would like to propose the following for processes beginning with pot filling:

Something combining pot and container for two purposes:

(i) Facilitating the mechanization of pot filling; and

(ii) Expanding the treating unit.

and satisfying the following conditions be produced to be tentatively referred to as seedling box.

i. Ease of assembly and disassembly.

ii. Light weight and strong build making prolonged use possible.

iii. Structure that makes carrying by a single person or 1 - 2 persons possible after nursing. Fig. 4 illustrates this proposal.

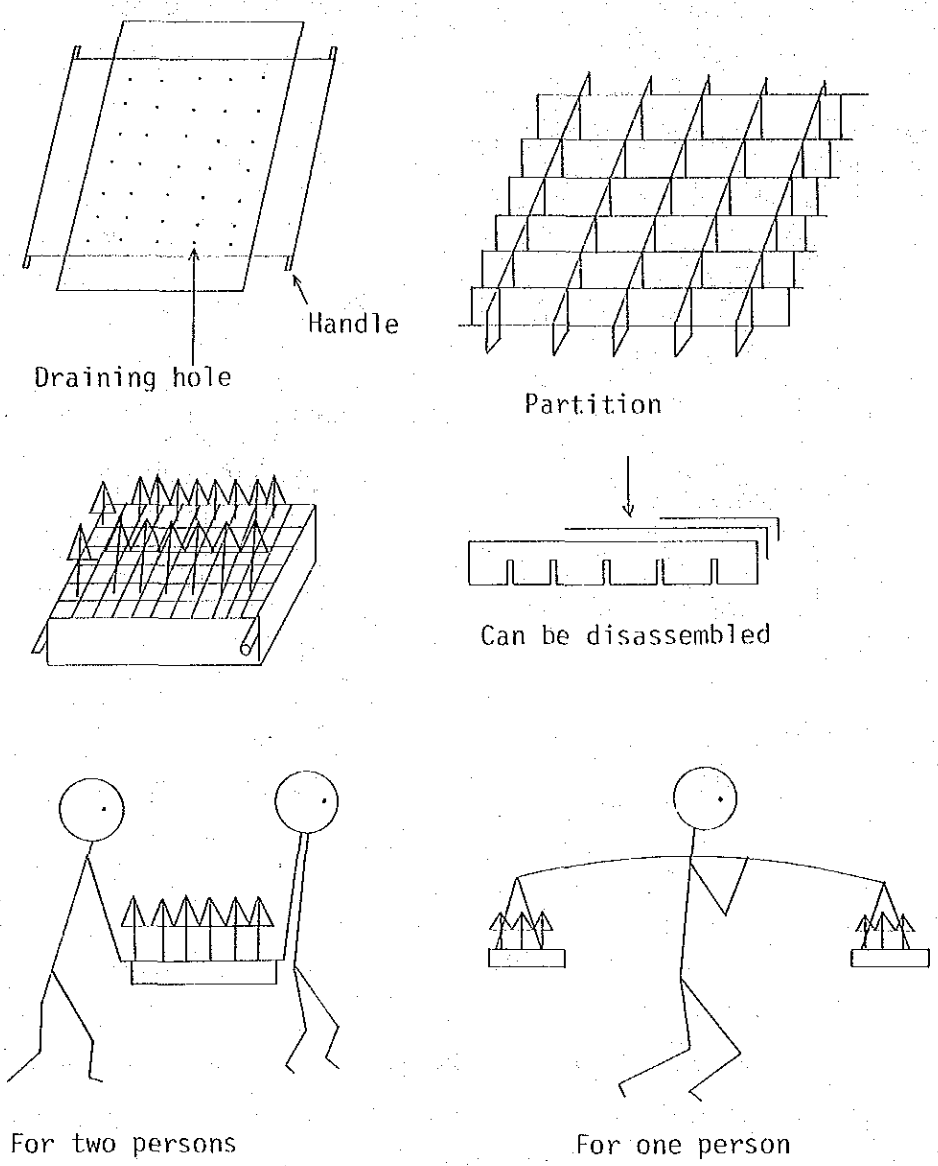


Fig. 4 Seedling box

Boxes be trial manufactured in two sizes: For one person (carrying two boxes) and for two persons (carrying one box).

(a) For one person: 18 kg, namely two 9 kg boxes each containing 30 seedlings.

(b) For two persons: About 36 kg consisting of 120 seedlings.

The filling machine which supplies soil to the seedling box will be structurally so devised as to cause a certain amount of soil to fall onto the box by operating a handle valve. It is illustrated in Fig. 5.

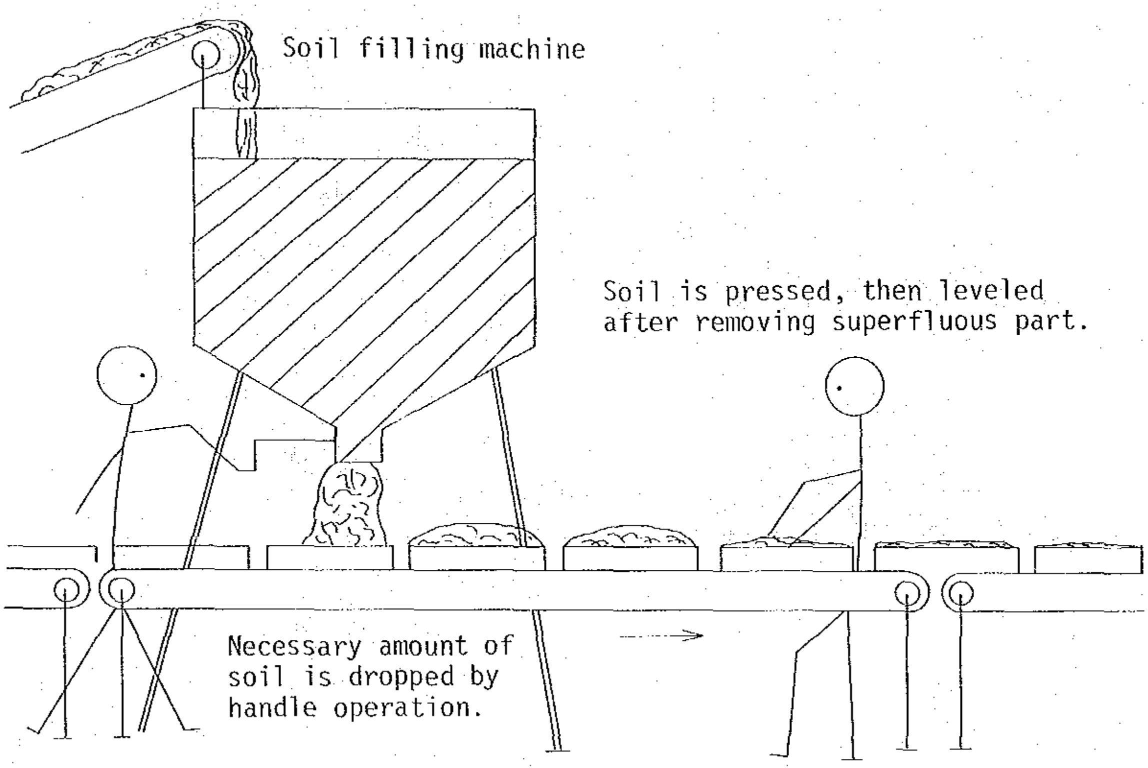


Fig. 5

(i) A sufficient amount of soil to fill the box is dropped by turning the handle of the filling machine.

(ii) Soil in the seedling box is compacted by pressing and superfluous part is removed.

(iii) The seedling box is carried to the nursery by a forklift or a belt conveyor and put in place.

(iv) Young seedlings are transplanted.

After nursing, the seedling box is directly carried to the planting site in the forestland and broken up on the trailer tractor and the seedlings are distributed one by one to the prescribed planting site. At this time, the roots of the seedlings must hold sufficient soil. It is necessary for the seedlings to be amply watered at the nursery prior to planting out. After breaking up the seedling box, the root section of each seedling must be squeezed in both hands and then distributed to the planting positions.

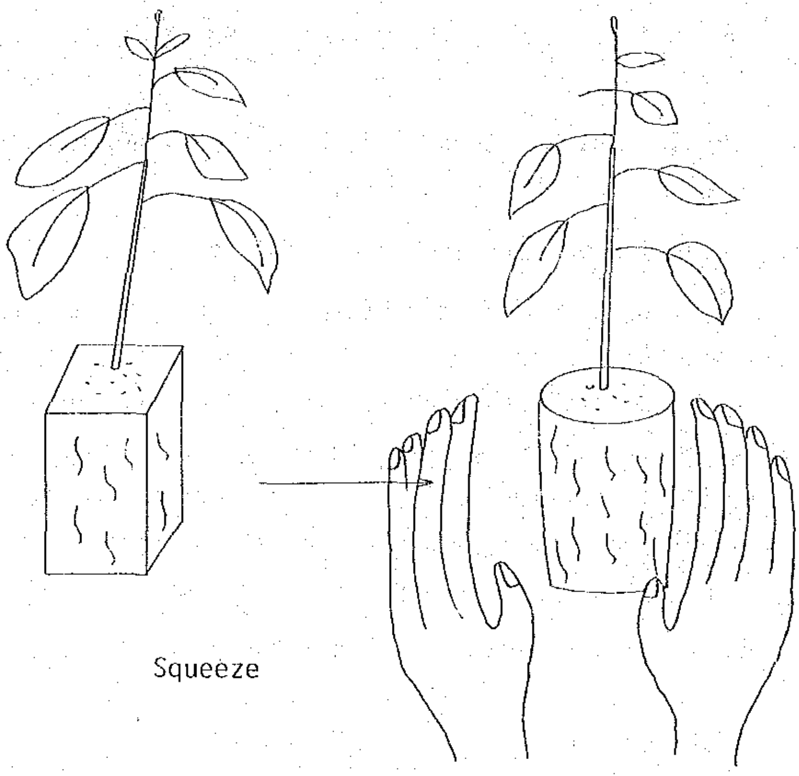


Fig. 6

h. Transplanting

Seedling boxes are arranged in the cleared nursery by a layout with consideration for the operation of tractors and forklifts and the rise of sprinklers. Seedlings are directly transplanted by manual work to seedling boxes that have been arranged.

Elaborate work, such as transplanting small and delicate young seedlings, is unsuitable for mechanical handling. Under the conditions of forestry, it would be better for efficiency if parts requiring human dexterity are left as manual work.

i. Nursing

Seedlings are raised in the nursery bed and, as they grow, they can be deployed on the basis of seedling boxes and, if they are taken by disease, they can be quarantined also on the basis of seedling boxes. In nursing, care must be exercised to prevent growth that is uneven between boxes, because, prior to planting-out, seedlings must be selected box by box. Also, supplement planting must be rapidly carried out because of the necessity to achieve a high survival rate of seedling for each box.

Nursing must be mechanized by means of chemical spraying from a tractor and the use of sprinklers.

j. *Selection of seedlings and planting-out*

Seedlings are selected box by box and, if the survival rate of seedlings is at a certain level (70 - 80% ?) or beyond, they planted out. Rejected seedlings are disposed of in the field after dismembering seedling boxes. Boxes with a survival rate below a certain level are dismembered at the nursery and healthy seedlings from them are re-packed in empty seedling boxes and used. The rejected seedlings are either re-raised or disposed of.

Under this project, it is now the practice in seedling selection and planting-out to take individual pots from the nursery bed, pack them in wooden containers and bring them by truck to the plantation. There, they are again re-packed in lighter containers for manual conveyance and brought to the planting site. Work efficiency in this process probably will be greatly improved by expanding handling lots.

A trailer tractor is used for plnating-out. Loading to the trailer is done by a forklift or a belt conveyor. This is illustrated in Fig. 7.

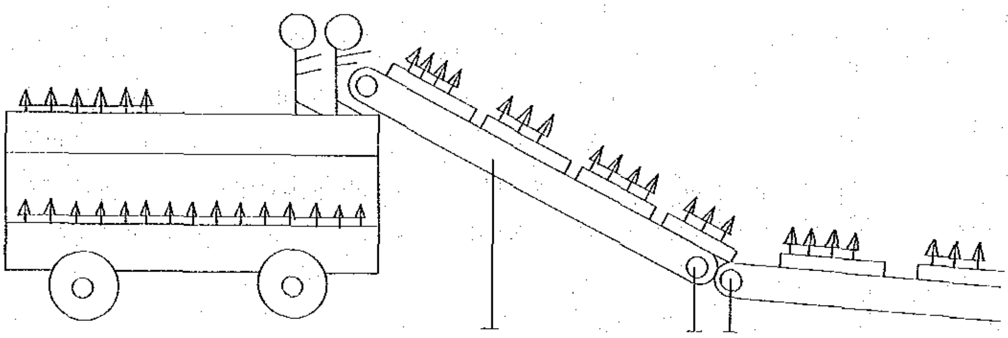


Fig. 7

A plural number of trailers drawn by a tractor or a vehicle proceeds toward the plantation. (Fig. 8)

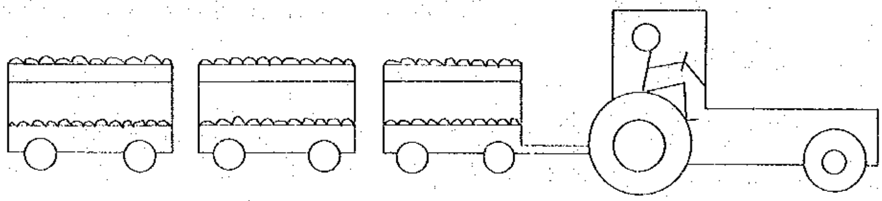


Fig. 8

Each trailer is detached at a necessary nearby place. Then, it is attached to a planting tractor and tracted to the site of planting work in the plantation. (Fig. 9)

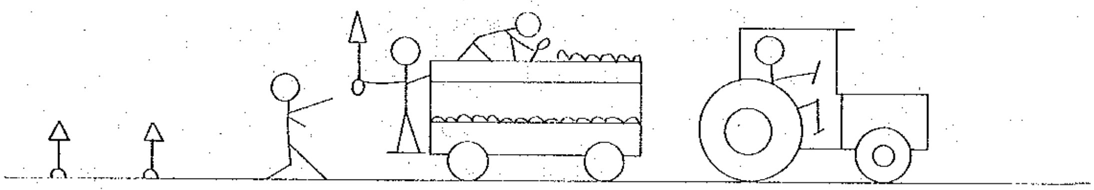


Fig. 9

In steep slopes, valleys and other places inaccessible to trailer tractors, seedlings are manually distributed to the planting site, using the one-man seedling box or the two-man seedling box illustrated in Fig. 4.

k. Planting

In planting, seedlings are first taken from the seedling boxes broken up on the trailer and placed on the ground according to the prescribed planting intervals after the land is plowed by a tractor. The distribution of seedlings is handled by a group of three as one man, walking, delivers seedlings received from the two who stay on the trailer. Seedling boxes that have been broken up for use are recovered for repeated use. After the distibution of seedlings by the trailer tractor, four or five planters plant them manually. Trailer speed, the speed of seedling unloading and the planting speed are adjusted for balance so that seedlings distributed can be promptly planted before their roots dry.

The above is the basic flow up to planting. Care is exercised to enhance the psssibility as a mechanized system by compromising it with manual work. And it is necessary to develop the following machines:

i. Seedling box

ii. Soil filling machine

iii. Conveying trailer

Though none of these are sophisticated machines, they are useful for the flow as a system. Much is expected of their trial manufacture and development.

l. Construction of forest road

Angle dozers D50A (12 ton class) and motor graders are used for construction and maintenance, respectively, of forest road. Thus, this work is completely mechanized. But if the bulldozers are to be renewed in the future, they must be replaced by D60A (16 ton class) or D80A (25 ton class) types. This can contribute to the increase of working capacity and the reduction of the fixed cost bearing rate. Further, parts supply will be greatly improved since these types are commoner.

The efficient use of bulldozers depends on how much their traveling distance can be reduced and how much their operating capacity can be increased. So, bulldozers must be daily kept on the field, if possible, thereby minimizing their traveling distance. Further, it is necessary to establish a system whereby daily oil supply and maintenance can be effected at the farthest end of the worksite. Also, security by the posting of guards is important.

m. Land preparation

At present, the removal of shrubs by the bulldozer and general and fine tilling by the tractor are practised by way of ground clearance but the rate of operation of the machines is very low. When using heavy equipment with a large amount of fixed cost to be bone (including depreciation), no merit of mechanization is forthcoming unless efforts are daily made to increase the rate of operation. The present state is only slightly more economical than manual work. If the rate of operation rises, the economic advantage will geratly improve.

To raise the rate of operation, therefore, I wish to propose the following:

i. Operators be paid on a piecework basis for hours worked.

ii. The piecework unit price be decided according to evaluated ability and be subject to revision.

iii. Two operators be assigned to a piece of heavy equipment, worked by set rotation and put to longer working hours each day. If only one operator is assigned to a piece, the rate of operation will inevitably fall.

iv. Mechanical breakdown be prevented by improving maintenance and assuring proper operation.

v. The short supply of oil and fat, fuel and parts be eliminated by careful stock control.

vi. Operators be favorably treated as special technicians and instilled with pride in their jobs.

It is yet to be seen whether crawler-type bulldozers should continue to be used in the future for land preparation including the removal of shrubs. This type is unsuitable for work over a large area. It is not economical to use them exclusively for work not requiring so much power in a large place like plantation. It is necessary to study and see if bulldozers of the wheel type can be used, instead. Certainly, the removal of tall trees from the valley may be something more than this type can handle. But it will be sufficient for the removal of shrubs from the upper and middle mountain-side. It is necessary to use the crawler type and the wheel type distinctively for different work. If the wheel type can be adopted, the economic advantage will further improve.

Land preparation for the fire belt is being performed similarly. The next three methods are now being tried: (i) Leaving the fire belt bare. (ii) Planting it with fire break trees. (iii) Planting it with a cover crop. But even with consideration for the costs and effects of these methods, something still remains to be indefinite. If fire break trees are planted, it is meaningless if no superior fire break trees are available and trees similar to the forest trees are used, instead. If so, should the fire belt be bare? In this case, brush cutting or plowing several times a year is necessary and the maintenance cost will amount to a great sum, considering the length of the fire belt that extends yearly, because brush cutting can never be omitted as long as the fire belt is left bare. Further, a fire belt is provided for 10 m on either side of a forest road but is it really necessary along the forest road? Especially, if it is left bare, why not use the forest road itself as a fire belt, instead, by widening the road? Thus, the bare land naturally can be maintained by the traffic of vehicles. If, then, the fire belt along a forest road is planted with fire break trees, the trees, when they grow, will prevent the road surface from drying during the rainy season and make the maintenance of the surface difficult. It is, therefore, more advisable to spend money for road widening rather than for building a fire belt. Further study is necessary on the optimum density and scale of fire belts.

At any rate, the work will be mechanized similarly to afforestation.

n. Tillage and digging of planting holes

Plows are now used for tillage but experience seems to show that disk plows are more suitable for the natural conditions of this project.

The earth auger is now being tried in digging planting holes but it is not proving effective for lack of experience and for the reason of physical strength. A self-propelled planting hole digging machine consisting of an earth auger attached to a tractor has been tested and proved to be sufficiently efficient for practical use. Thus, much is expected of its further utilization.

o. Brush cutting

Efforts are now being exerted to improve on the use of the bush cutter. The reasons for the desired improvement are as follows:

i. Lack of experience in using.

ii. Unsatisfactory saw setting.

iii. Inadequate physical strength for work holding an engine under the blazing sun.

iv. Careless handling of machine which results in frequent loss of parts and mechanical breakdown.

It is most important to provide practical and theoretical training and supply saws that have already been set. It is known from experience at the stage of tentative use that the local workers can be efficient and economically useful if only they are accustomed to the use of machines and can permanently use them.

Though they are still inexperienced in the use of self-propelled brush cutting machines, brush cutting can be efficiently performed by, say, using a cutter attached to a tractor. Also, the effect of brush cutting can be produced by tilling between rows. Work can be distictively performed by using bush cutters for valleys and steep slopes and using the self-propelled type for the level ground.

Indeed, much is expected of the increase of efficinecy through the furtherance of mechinization since adequate brush cutting at the initial stage of growth of planted trees can produce a profound effect on their growth.

4. Background of mechanization

Mechanization is, in a way, a battle against cost. An ideal system cannot be developed without a deserved cost but the development cannot be pushed unless the cost is more or less ignored in the meantime. But once developed and completed, a system must be so efficient that it can make up for the development cost.

Further, mechanization must presuppose more than a certain volume of work. The larger the scale of mechanization is, the greater the fixed cost is. So, a large volume of work is necessary. It is ideal if the volume of work continues to be to the full capacity of the system concerned. The large plan to rapidly restore forests in the wildernesses of Sumatra variously estimated at 600,000 ha and 1,000,000 ha makes mechanized afforestation all the more important.

Under these circumstances, the following conditions seems to be necessary as the background of the conduct of mechanization:

(1) At every process of work, process analysis and cost analysis must be made and stirct cost consciousness must be developed. And the methods of these analyses and the methods of recording must be established.

(2) There must be a structure for practicing and supporting trial manufacture, improvements, etc. and a habit and system to overcome difficulties and dead-locks in the course of mechanization by ingenuity and study.

(3) Employment of superior mechanics and operators. There must be a consistent mechanization policy based on a long-range outlook concerning matters including the selection and unification of machine types and the unification of manufacturers.

(4) One must not use machines as individual machines and always remember that their effects multiply when they are used as system machines that are closely related.

(5) The forcible mechanization of processes must be avoided.

Various opinions may prevail as to whether this effort to further mechanization under the conditions of developing countries and in spite of national differences and the differences of the way of thinking is justifiable or whether it is unbalanced as a whole. But it seems that there is no choice but to believe that the Republic of Indonesia is strongly motivated to afforest its vast wildernesses that unmistakably exist.