Leaflet No. 5/ 94-95

Government of the Union of Myanmar
Ministry of Forestry
Forest Department
Forest Research Institute
Yezin

The Effect on Different Refilling Methods of Site Preparation on Growth And Survival of *Eucalyptus camaldulensis* in the Central Dry Zone of Myanmar

U Saw Win B.Sc (For.) (Rgn.). Grad Dip., (For.) (ANU).
Assistant Director

and
U Maung Maung Tint B.Sc (For.) (Rgn.). Staff Officer,
Forest Research Institute

January, 1995 Yezin

မြန်မာပြည်အလယ်ပိုင်းအပူပိုင်းဒေသသစ်တောနယ်တွင် ကမာကျူလန်းစစ် ယူကလစ် သစ်မျိုးကိုကျင်း အရွယ်အစား(၂)မျိုးတွင် ကျင်းဖို့ နည်းစနစ်(၃)မျိုးဖြင့် စမ်းသပ်စိုက်ပျိုးခြင်း။

ဦးစောဝင်း B.Sc.(For.)(Rgn.), Grad Dip. Sc (For.) (ANU))
လက်ထောက်ညွှန်ကြားရေးမှူး၊ သစ်တောသုတေသနဌာန

နှင့်

ဦးမောင်မောင်တင့်၊ B.Sc.(For.)(Rgn.)
ဦးစီးအရာရှိ၊ သစ်တောသုတေသနဌာန

စာတမ်းအကျဉ်းချုပ်

မြန်မာနိုင်ငံဝံ အလယ်ပိုင်းမိုးနည်းရေရှားဒေသတွင် များပြားသောထင်းလိုအပ်ချက်ကို ဖြည့်ဆည်းနိုင်ရန် အကြီးမြန်သည့် ကမာကျူလန်းစစ် ယူကလစ်သစ်မျိုးကို လွန်ခဲ့သော၊ ဆယ်စုနှစ်အချို့ မှစ၍ စမ်းသပ်စိုက်ပျိုး ခဲ့ပါသည်။ အဆိုပါစိုက်ခင်းများမှ အများဆုံး အကျိုးအမြတ်ရရှိစေရန်အတွက် ထင်းအများဆုံးထွက်ရှိနိုင်မည့် သစ်မျိုးနှင့် စိုက်ပျိုးနည်းစနစ်များကိုဖော်ထုတ်ရန်လိုအပ်ပါသည်။ ၁၉၉၂ခုနှစ်တွင် မကွေးမြို့နယ် ဒေါင်းနေ ဒေသ၌ကျင်းအရွယ်အစား (၂) မျိုးတွင် မြေပြန့်ဖို့ခြင်းနည်းအမျိုးမျိုးကို အသုံးပြု၍ ကမာကျူလန်းစစ် ယူကလစ်သစ်မျိုး၏ရှင်သန်မှုနှုန်းနှင့် အမြင့်ကြီးထွားမှု စမ်းသပ်မှုကို ပြုလုပ်ခဲ့ပါသည်။ စမ်းသပ်မှုတွင် ဖက်တိုရီရယ်နည်း စနစ်ကို အသုံးပြုပါသည်။

The Effect on Different Refilling Methods of Site Preparation on Growth And Survival of *Eucalyptus camaldulensis* in the Central Dry Zone

of Myanmar

U Saw Win, B.Sc.(For.)(Rgn.),Grad Dip. Sc (For.)(ANU))
Assistant Director

and

U Maung Maung Thint, B.Sc.(For.)(Rgn.), Staff Officer,
Forest Research Institute.

Abstract

Fast growing species like *E.camaludensis* have been planted since past few decades to meet the heavy demand for demand for fuelwood in the central dry zone of Myanmar. In order to get the maximum returns from these plantations, it is necessary to find out which species and method of treatment will give the highest fuelwood yield for the plantations. A trial on the effect of survival percentage and height growth of *Eucalyptus camaldulensis* species for different refilling methods was performed with two kinds of pits in the Daung-ne area. Magwe Township in1992. The design applied was a factorial arrangement in randomised. block design.

Content

Page

1. Introduction

The underlying objectives in the dry zone afforestation scheme are:-

1. To resolve the active fuelwood problem,
2. To ameliorate the environmental conditions,
3. To arrest and contain soil degradation which would otherwise lead to desertification eventually,
4. To encourage the establishment of community fuelwood plantation and woodlots for the socioeconomic development,
5. To inculcate public awareness on the important of the forests and tree cover in the dry zone.

With the stated objectives dry zone afforestation had gone well into the fourth decade, sometimes covering large areas in certain years and not without hiatus dropped again in coverage in some years.

Among various tree species planted, *Eucalyptus* was one of the tree species planted extensively at one time to resolve the acute fuelwood problem and on the merit of its multiple usefulness and adaptability.

It is found that *E.camaldulensis* match very well with the prevailing environmental conditions. The growth response under such a harsh condition well surpassed other species. Therefore *E.camaldulensis* is the most suitable species for the dry zone.

This study is to determine the best choice of the pit size among two different kinds namely (4'x 4' x 1'+1'x1'), and (6'x 1.5' x 1.5'+ 1.5'x 1.5')$^{x1.5'}$ with the tree planting pit inside it. The study also involves site preparation, and the method of refilling the pits with planting medium.

As the Nine Districts Greening Project with top priority status is under way, and the project being a large scale with an input of K 66.33 million covering 51300 acres, this issue of finding the right technology has become most imperative.

The study was based on the outcome of the presented regarding pit sizes and growth responses at the 1988 Forest Research Session.

2. Materials and Methods

The experiment was out carried in the dry zone area, in Daung-ne, Magway Township in 1992.

Factorial lay out in randomised complete block design was applied. The species planted in this experiment was *Eucalyptus camaldulensis.* The trial plot used two different sizes of pits and three different refilling methods.

The two different sizes of pits are;-

1. (4'x4'x1' pit with 1'x1'x1' middle hole) (P4)
2. (6'x1.5'x1.5'x pit with 1.5'1.5'x1.5' middle hole) (P6)

In refilling the pits the following methods were tried;

1. Half- flat refilling method (f1)
2. Pyramidal- shape refilling method (f2)
3. Middle -hole refilling method (f3)

Each plot contains 49 seedling and the experiment was replicated four times in the location. The pits were dug at a spacing of 12' x12' as practiced in the central dry zone of Myanmar. In addition, weeding and soil working operations were also carried out as practiced in the district.

Soil smaples of the location were collected at 0-10 cm, 20-40 cm, 60-80cm, and 100-110 cm in depth. Texture, P^H and N.P.K content of the soil samples were analysed at the soil, laboratory in Yezin.(see table 1)

Climatic data was collected from the nearest available meteorological station. Monthly and annual rainfall data are presented in table. 2

Survival and height assessment were carried out in the month of April every year. Statistical analysis were carried out to find out the most efficient combination of the above pit sizes and refilling methods.

3. Results

The results of survival and height growth in the first year and height growth in the second year are as shown in table (3,5) and (7) and in figures 1,2 and 3.

Survival percentage

Analysis of variance for survival percentage in 1993 are presented in table 4 and 5. There is no significant difference in survival of *E.acmaldulensis* between two pit sizes (4'x 4' x 1' and 6'x 1.5' x 1.5') tested. Significant difference among different refilling methods was observed. Half-flat refilling and middle-hole refilling methods were better than pyramidal-shape refilling method. There is no interaction between two sizes of pit and difference refilling methods.

Height growth

The analysis of variance of average height growth in 1993 and 1994 were presented in table 6 and 8 respectively. There were no significant differences in height growth of *E.camaldulensis* between the two pit sizes (4'x 4' x 1' and 6'x 1.5' x 1.5')and among the three different refilling methods. No interaction between different sizes of pit and refilling methods was also observed. The difference in height growth among blocks was found to be significant. The flat area number 2 is better than the other three blocks.

Eucalyptus plantations in the dry zone reforestation program were more successful than the native species in survival rate and growth (Ko Ko Gyi, 1986). Due to its inherent characteristics such as fast-growing and high coppicing capability, evergreen leaves and low soil nutrient consumption *Eucalyptus* may be recommended as the most suitable species for the dry zone area where firewood is scarce and the climate and soil conditions are severe.

4. Discussion

Poor soil type such as thin top soil, nutrient deficient soil , and inundated soil must be seen into to have a good filling medium before planting for favourable growth of young seedlings. Some of the seedlings included in the experiment died during the severe hot in dry season and sending up coppice shoots again during the rains. For instance, in the poor soil type, preparation of the soil is necessary to guarantee survival and to create same conditions for seedling survival throughout the plantation area. If it is available, good soil type should be selected as fuelwood plantation areas to enhance the fuelwood productivity of the plantation.

Height growth of the *Eucalyptus camaldulensis* species was found to be good condition reaching more than 3-8 feet within a period of two years. Survival percentage was reasonably good as presented in table (3). However, some seedlings were badly attacked by shoot borers, causing the shoot and top branches to break off and thus affecting the average height.

Now, it is required to introduce the bottom up approach in establishing sound forests resources management rather than top down approach if we need successful results from these plantations, mainly due to inherent site factors. It is very important to make the whole community aware of the importance of trees and forests for their livelihood and survival in terms of food security. After planting, it should be extremely important to organize on management operations such as weeding, protection against fire and grazing and systematic cutting at the time of harvesting.

In developing countries, plantations extensively established were not properly cared for which call for sound, management system with the understandable and cooperation by the rural dwellers about the fact they are the real beneficiaries from these plantations when the plantations are ripe for felling; if not (without their support)it will be a failure as before. For a sustainable forest resources management in future, it is of high importance that villages take keen interest and get some kind of incentives from fuelwood plantations.

5. Conclusion

1. In Daung-ne area, survival and height growth of *E.camaldulensis* planted in two pit sizes (4' x4' x1' and 6' x1.5' x 1.5') are not different.
2. It appeared that half-flat refilling and middle-hole refilling methods were better than pyramidal- shape refilling method in survival in the first year.
3. The experiment should be continued in other areas of dry zone in order to identify the most suitable methods of site preparation for these adverse sites.

Table 1. Soil condition of the experimental area in Daung-ne

Description	Depth	P^H	Total	N%	P%	K%	O.M %	Texture		
								Sand	Silt	Clay
Flat 1	0.2	8.645	Trace		0.00275	0.0016	0.27	87	10	2
	20.4	8.33	Trace		0.00146	0.0012	0.2	82	8	8
	40.6	8.23	Trace		0.00152	0.0014	1.01	86	8	4
	60.8	8.32	Trace		0.00158	0.0009	0.9	83	8	8
	80.1	8.38	Trace		0.0011	0.0012	0.96	86	6	6
Flat 2	0.2	8.795	Trace		0.00306	0.0014	0.98	85	6	6
	20.4	8.53	Trace		0.00294	0.0013	0.75	85	6	6
	40.6	8.57	Trace		0.00273	0.0011	0.89	86	6	6
	60.8	8.845	Trace		0.0025	0.0011	0.84	86	6	6
	80.1	8.08	Trace		0.00175	0.0009	1.1	88	6	4
Slope	0.2	8.25	Trace		0.00028	0.0007	1.07	82	10	6
	20.4	8.25	Trace		0.0013	0.0008	1.01	87	6	4
	40.6	8.25	Trace		0.0002	0.0008	0.2	90	6	2
	60.8	8.35	Trace		0.00014	0.0006	0.18	91	6	2
	80.1	8.03	Trace		0.00012	0.0007	0.42	90	6	2
Daung-ne	0.2	7.775	Trace		0.00012	0.001	1.56	62	26	10
	20-40	7.78	Trace		0.00008	0.0007	1.14	49	34	14
	40.60	7.765	Trace		0.0001	0.0008	1.32	46	38	12
	60.80	7.86	Trace		0.0001	0.0008	1.43	59	28	10
	80.100	8.795	Trace		0.0001	0.0015	1.46	59	28	10
	First Layer	8.02	Trace		0.00012	0.0011	0.63	92	4	1
	Second Layer	8.235	Trace		0.00158	0.0013	0.24	87	10	1
	Third Layer	7.275	Trace		0.00052	0.0012	0.2	91	6	1
	First Layer	7.57	Trace		0.00002	0.001	0.76	61	18	20
	Second Layer	7.7	Trace		nil	0.0006	1.04	55	22	20
	Third Layer	7.825	Trace		0.00002	0.0007	1.23	33	46	18

Table 2. Monthly and Annual Rainfall in inches
Location-Daung -ne, Magway Township

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Total
1989	-	-	0.83	0.67	1.07	4.82	3.94	6.78	5.2	7.47	-	-	30.78
1990	-	0.12	-	0.28	11.06	2.63	2.34	8.23	8.01	1.82	1.22	0.12	35.83
1991	-	-	-	3.89	0.56	2.8	3.07	2.66	1.14	4.25	3.35	0.94	22.66
1992	-	0.08	-	0.04	6.31	4.13	3.91	3.07	7.26	10.1	1.14	0.08	36.15
1993	-	0.08	0.16	-	5.16	5.32	3.5	3.26	5.6	4.84	-	-	27.92

Table 3 . Survival percentage in 1993.

Pits	Filling Methods	Block				Fillings Sub Totals	Pits Totals
		F1	F2	S	R		
P4	f1	100	93	89	94	376	
	f2	97	90	83	88	358	
	f3	100	95	95	100	390	
	Block subtotal	297	278	267	282		1124
P6	f1	95	97	94	100	386	
	f2	93	93	88	85	359	
	f3	93	89	100	93	375	
	Block subtotal	281	279	282	278		1120
All pits	f1	195	190	183	194	762	
	f2	190	183	171	173	717	
	f3	193	184	195	193	765	
	Totals	578	557	549	560		2244

Table 4 . Analysis of variance for survival percentage in 1993.

Source of variation	d .f	Sum of square	Mean square	F. ratio	F. value	
					0.05	0.01
Blocks	3	75	25	1.54	3.29	5.42
Treatments	5	221.5	44.3	2.729	2.9	4.56
Pits	1	0.66	0.66	0.0407	4.54	8.63
Filing method	2	180.75	90.375	*5.5673	3.68	6.36
2f 2 v.s (f1+ f3)	1	180.1875	180.1875	*11.1001	4.54	8.68
f3 v.sf1	1	0.5625	0.5625	0.0347	4.54	8.68
Pits .x filling	2	40.09	20.045	1.2348	3.68	6.36
Error	15	243.5	16.233			
Total	23	540				

Table 5 . Average height in 1993.

Pits	Filling Methods	Block				Fillings Sub Totals	Pits Totals
		F1	F2	S	R		
P4	f1	2.25	2.58	2.16	2.41	9.4	
	f2	2.25	3.16	2.41	2	9.82	
	f3	2.16	2.58	2.08	2.41	9.23	
	Block subtotal	6.66	8.32	6.65	6.82		28.45
P6	f1	2.16	1.25	2.75	2.16	8.32	
	f2	1.75	2.41	1.75	1.16	7.07	
	f3	2.33	1.66	2.5	2.33	8.32	
	Block subtotal	6.24	5.32	7	5.65		24.21
All pits	f1	4.45	3.83	4.91	4.57	17.72	
	f2	4	5.57	4.16	3.16	16.89	
	f3	4.49	4.24	4.58	4.74	18.05	
	Totals	12.9	13.64	13.65	12.47		52.66

Table 6 . Analysis of variance for height of site preparation and pit size in 1993.

Source of variation	d .f	Sum of square	Mean square	F. ratio	F. value	
					0.05	0.01
Blocks	3	0.169	0.0563	0.2643	3.29	5.42
Treatments	5	1.2015	0.2403	1.1303	2.9	4.56
Pits	1	0.7491	0.7491	3.5235	4.54	8.68
Filing method	2	0.0893	0.0447	0.2103	3.68	6.36
Pits.x refilling	2	0.3631	0.1816	0.8542	3.68	6.36
Error	15	3.1883	0.2126			
Total	23	4.5583				

References

P4 = (4' x4' x1' + 1' x 1' x1')
P6 = (6' x1.5 'x 1.5 ' +1.5 ' x 1.5 'x 1.5 ')
f1 = Half - flat refilling method
f2 = Pyramidal -shape refilling method
f3 = Middle -hole refilling method

F1 = Flat 1
F2 = Flat 2
S = Slope
R = Ridge

Table(7). Average height in 1994.

Pits	Fillings Methods	Block				Fillings Sub Totals	Pits Totals
		F1	F2	S	R		
P4	f1	4.96	6.49	4.91	6.05	22.41	
	f2	5.96	7.45	4.17	2.77	20.35	
	f3	5.39	6.89	4.32	5.67	22.22	
	Block subtotal	16.31	20.78	13.4	14.49		64.98
P6	f1	3.9	5.58	3.6	5.55	18.63	
	f2	5.19	6.39	8.06	5.06	24.7	
	f3	5.14	7.36	4.42	4.76	21.68	
	Block subtotal	14.23	19.33	16.08	15.37		65.01
All pits	f1	8.86	12.07	8.51	11.6	41.04	
	f2	11.15	13.84	12.23	7.83	45.05	
	f3	10.53	14.2	8.74	10.43	43.9	
	Totals	30.54	40.11	29.48	29.86		129.99

Table 8 . Analysis of variance of height in 1994.

Source of variation	d .f	Sum of square	Mean square	F. ratio	F. value	
					0.05	0.01
Blocks	3	12.974	4.3247	*3.3949	3.29	5.42
Treatments	5	5.2538	1.0508	0.0249	2.9	4.56
Pits	1	0.00011	0.0001	0.0001	4.54	8.68
Filing method	2	1.066	0.533	0.4184	3.68	6.36
Pits.x refilling	2	4.1877	2.0939	1.6437	3.68	6.36
Error	15	19.1086	1.2739			
Total	23	37.3364				

References

P4 = (4' x4' x1' + 1' x 1' x1')
P6 = (6' x1.5 'x 1.5 ' +1.5 ' x 1.5 'x 1.5 ')
f1 = Half - flat refilling method
f2 = Pyramidal -shape refilling method
f3 = Middle -hole refilling method

F1 = Flat 1
F2 = Flat 2
S = Slope
R = Ridge

Figure -1

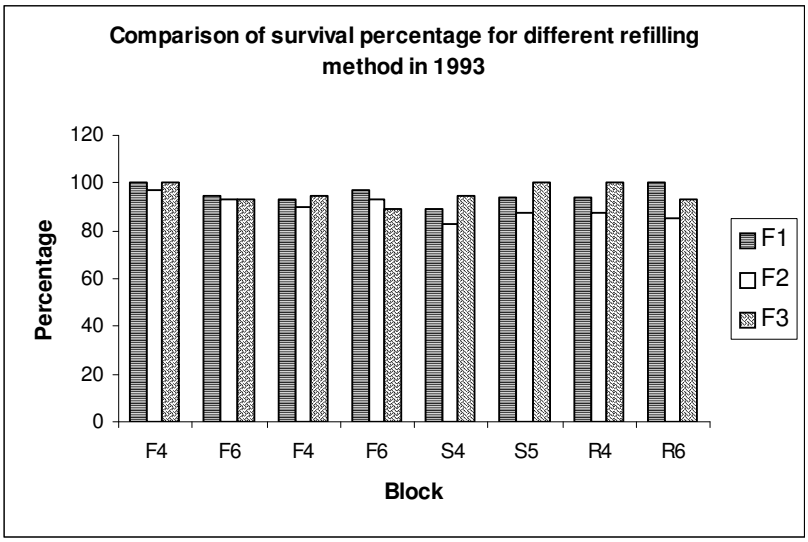


Figure - 2

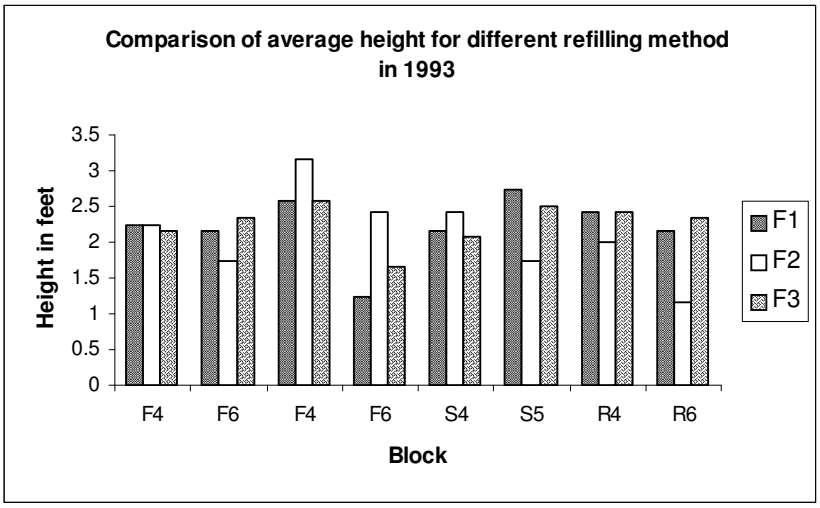
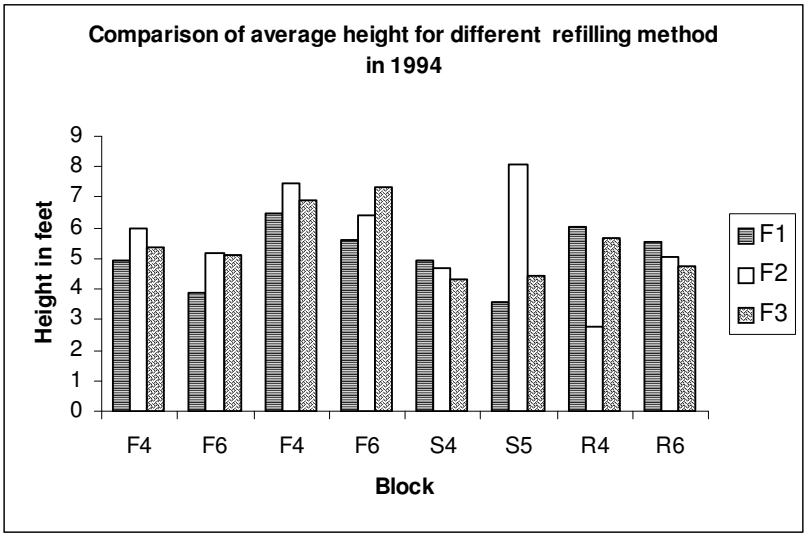


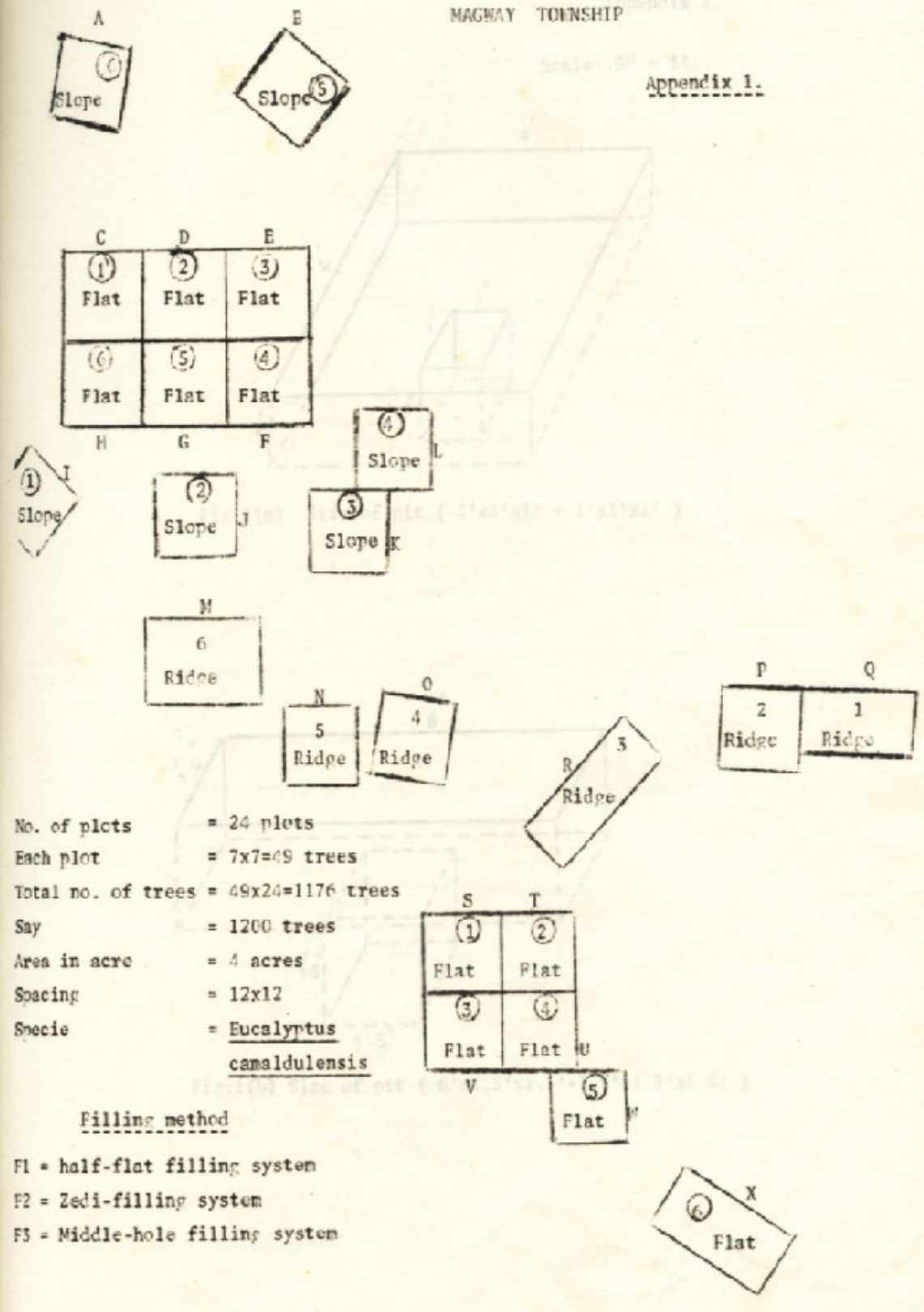
Figure -3



DAUNG NE SITE PREPARATION EXPERIMENTAL PLOT (1992-93)

MAGWAY TOWNSHIP

Appendix 1.



No. of plots = 24 plots
Each plot = 7x7=49 trees
Total no. of trees = 49x24=1176 trees
Say = 1200 trees
Area in acre = 4 acres
Spacing = 12x12
Specie = Eucalyptus camaldulensis

Filling method

F1 = half-flat filling system
F2 = Zedi-filling system
F3 = Middle-hole filling system

Appendix 2.

Scale .5" = 1'

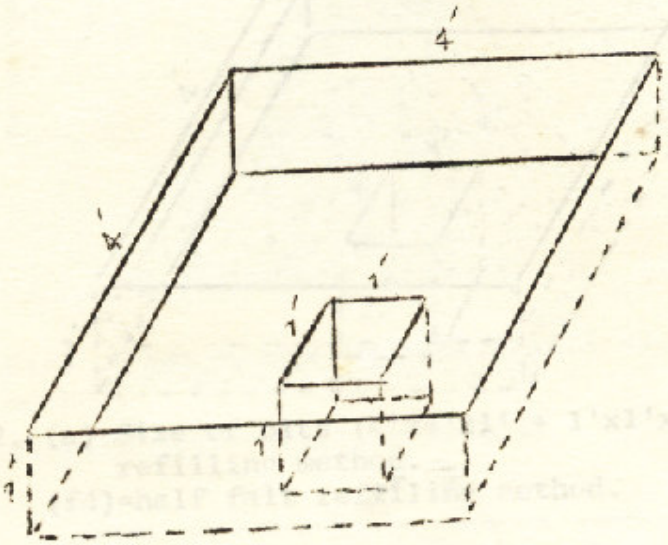


Fig.1(a) Size of pit (4'x4'x1' + 1'x1'x1')

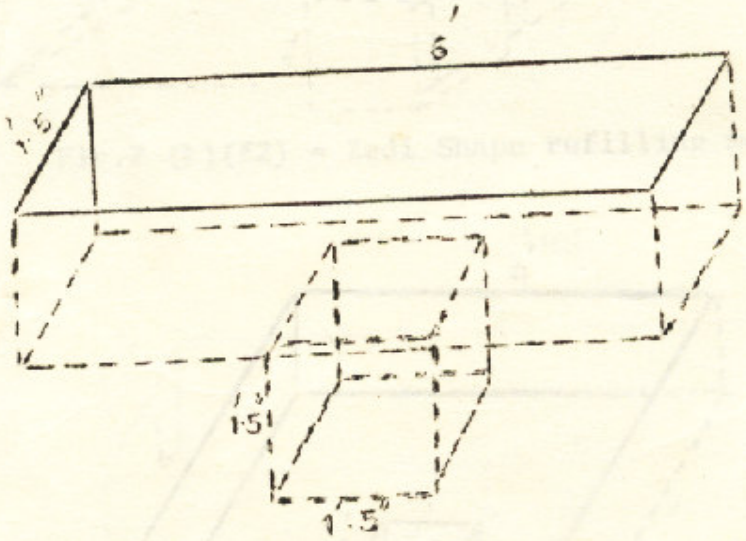


Fig.1(b) Size of pit (6'x1.5'x1.5'+1.5'x1.5'x1.5')

Appendix 3. Scale .5" = 1'

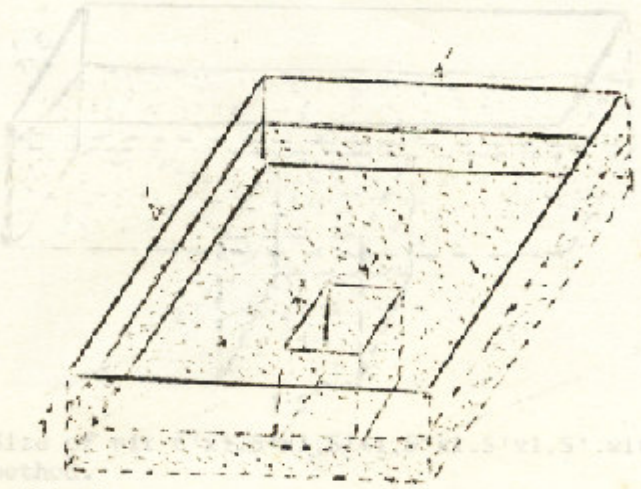


Fig.2. (a) Size of pits (4'x4'x1' + 1'x1'x1') with refilling method.
(f4)=half falt refilling method.

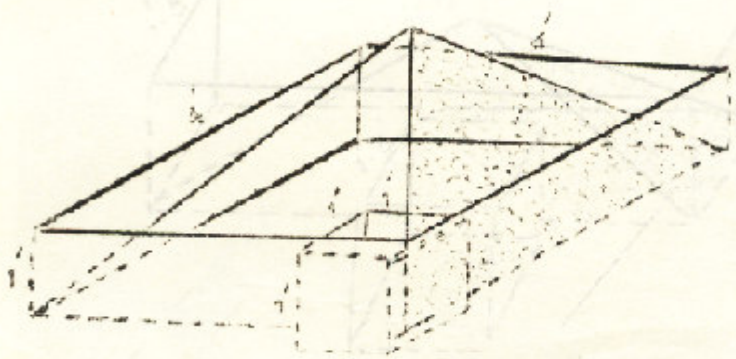


Fig.2 (b)(f2) = Zadi Shape refilling method.

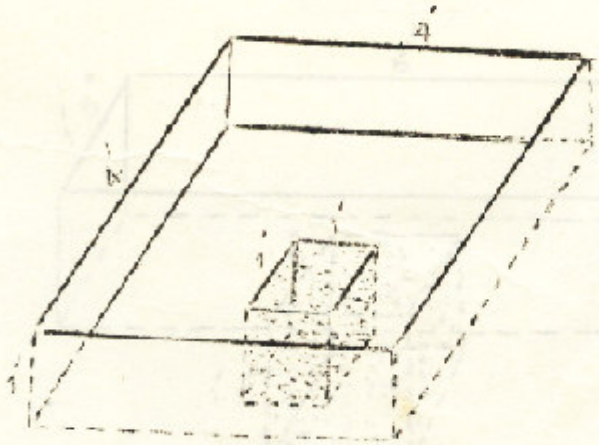


Fig.2. (c)(f3) = middle-hole refilling method.

Appendix 4.

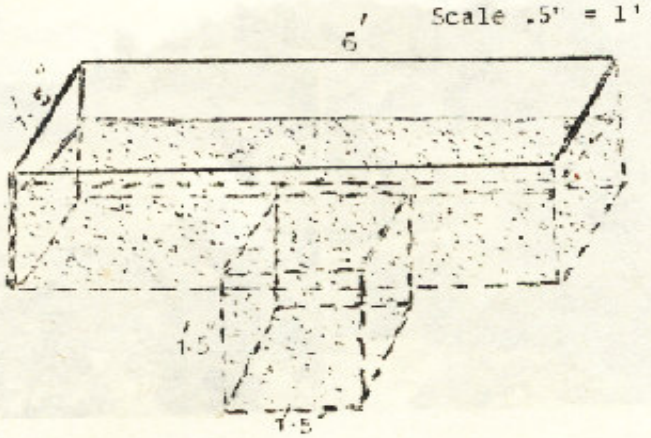


Fig.3 Size of pit 6'x1.5'x1.5'+1.5'x1.5'x1.5' with refilling method.

f1=half flat refilling method.

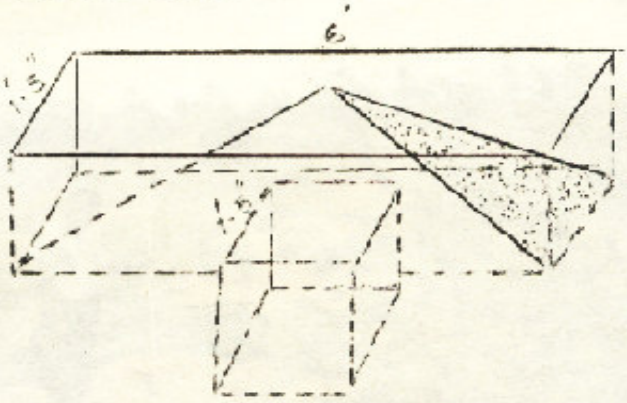


Fig.3(b) refilling method f2=Zedi shape refilling method.

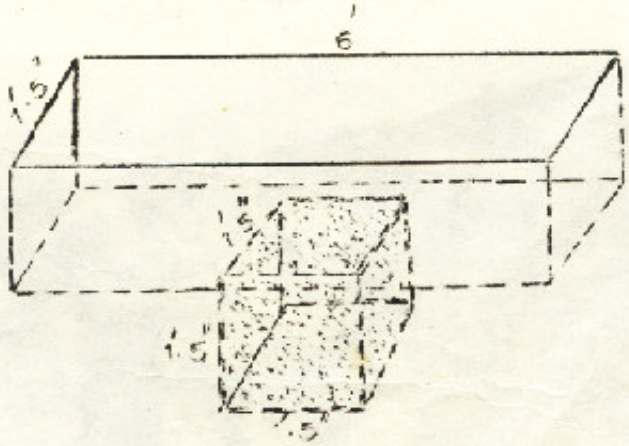


Fig.3(c) refilling method f3=middle-hole refilling method.

Flat - Area

Ridge - Area

Slope - Area

Established year = 1992-93

Area = Ridge area

(1) **4' x 4' x 1' f3 = Middle hole filling method**

(2) **6' x 1½ x 1½ f1 = half - flat filling method**

References

1. Anon (1983). Firewood crops. Shrub and tree species for energy production. Vol.2. National Academy of Science, Washington D.C.
2. Anon(1980). Firewood crops. Shrub and tree species for energy production. National Academy of Science, Washington D.C.
3. D.J. Boland (1989). Trees for the Tropics. Growing Australian Multipurpose Trees and Shrubs in Developing Countries.
4. Freeze, F.(1967). Dlementary statistical methods for foresters (Agriculture handbook 317). U.S. Department of Agriculture Forest Service.
5. John W. Turnbull (1986). Multipurpose Australian Tree and Shrubs. Lesser known species for fuelwood and Agroforestry. Australian Centre for International Agricultural Research, Canberra.
6. John W.Turnbull (1986). Australian Acacias in Developing Countries. Proceeding of and International Workshop held at the Forestry Training Centre, Gyimpie. Old, Australia
7. Ko Ko Gyi (1986). Species trial for fuelwood production.
8. Ko Ko Gyi and Kyi Win (1989). Trial Planting of *Acacia senegal* and *Acacia auriculiformis* in the Central DryZone of Myanmar. F.R.I Leaflet No.2/88-89.
9. Sein Thet and Tin Tin Ohn (1983). Some Physical and Chemical Properties of Dry Zone Forest Soils, F.R.I Leaflet No.11/82-83.
10. Tin Maung Kyi (1993). Nine District Greeding Projects .
11. Weber F.R.(1977). Reforestation in arid lands .