

## **THE ECONOMICS OF REPLANTING IN RUBBER PLANTATIONS PART 1: COST OF IMMATURE UPKEEP**

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### **INTRODUCTION**

Replanting of rubber is considered as a long term investment. The cost of production (COP) is a key factor which determines the economic viability of this particular farm activity. For convenience, cost of production can be broadly split into two categories viz cost of immature upkeep (including the initial investment) and cost of mature upkeep. This paper attempts to estimate the cost of immature upkeep with special reference to the estate sector.

An unproductive period of 6 years is assumed in the analysis. Input data on labour and material were gathered from a sample of 135 fields, planted with RRIC 100 Series Clones. The sample was randomly selected from 15 rubber estates located in Kegalle, Kalutara and Ratnapura districts on the basis of 5 estates per district.

#### **The components of immature upkeep**

The main components of immature upkeep are land preparation, field establishment and upkeep during the immature period (up to the stage of tapping). The field operations that fall into the above three components consist of uprooting and land clearing, possibly terracing, cutting drains, purchasing of planting materials, fertilizers and pesticides, establishing and maintaining cover crops and the complete taking care of the young plantation until it reaches maturity or tappable stage.

#### **Labour rates for land preparation (Uprooting and clearing)**

The initial operations to be carried out in land preparation are : (a) Felling of old rubber trees, (b) removal of stumps, (c) cutting and stacking of fire wood and (d) removal of roots. The required man power for these operations is given in Annex 1. The total labour requirement to complete these four operations is nearly 327 man days per hectare. The distribution of man days by the type of operation is shown in Figure 1. Nearly half of the total labour force is needed for cutting and stacking of fire wood. Yet, in most instances all the above operations are undertaken at free of charge by the contractor (as a part of the agreement) who is supposed to purchase the uprooted trees either for fuelwood or timber.

Nevertheless, in places where selling of old rubber trees are not possible (largely due to the locality of the land where transportation of rubber wood is extremely difficult), the land owner has to bear the entire cost of uprooting and clearing. Yet, part of the expenditure can be recovered in the case of smallholders through the replanting subsidy scheme. However, financial assistance of such nature is presently not available to the estate sector.

### **Labour and material requirements for field establishment and aftercare**

The labour rates and physical quantities of the materials required for each operation involved in field establishment and aftercare are given in Annex 2. Field establishment broadly consists of (a) removal of Fomes infected patches, (b) lining, (c) cutting of drains and silt pits, (d) terracing, (e) holing, (f) filling of holes and (g) planting of trees.

The main field operations that fall into the category of aftercare are (a) ground cover establishment and management, (b) fertilizer application, (c) supply of vacancies, (d) weeding and (e) pest and disease control.

However, certain expenditure components such as fencing, maintenance of roads, buildings, factories, offices, workshops, housing, machinery, vehicles are not included into the analysis. The main reason for omitting such expenses is that they tend to vary to a great extent from one estate to another.

### **Input prices**

A wage rate of Rs.83/ per day is assumed throughout the analysis. This is the current wage rate (all inclusive) applicable to the estate sector. The prices of material inputs are given in Annex 3. The type of inputs used during the immature period consist of (a) planting material (b) cover crop seeds (c) chemical fertilizers and (d) chemicals for pest and disease control.

### **Cost of immature upkeep**

The cost of immature upkeep can be calculated by combining the information given in Annex 1 and Annex 2. The distribution of the cost of immature upkeep by activity according to labour and material is given in Table 1. Although, 79% of the total expenditure consists of labour wages, the entire Rs.129,500/ha spent during the immaturity period has to be treated as an investment as it will not yield any return during the first 5-6 years.

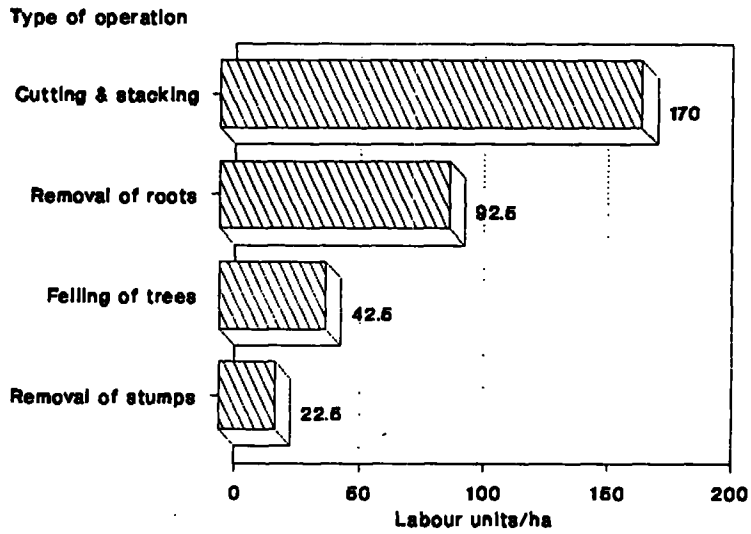


Fig. 1. Labour requirement for land preparation by type of operation

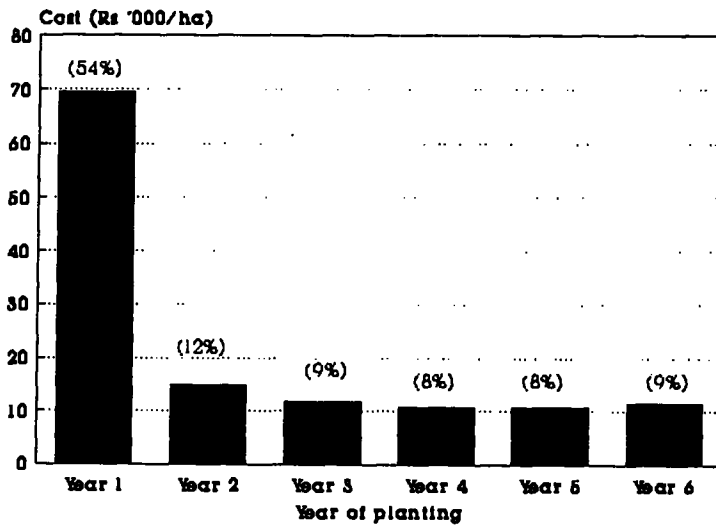


Fig. 2. Cost of immature upkeep by age of the crop

The most expensive operations are (a) weeding (ground cover management), (b) uprooting and clearing and (c) fertilizer application which account for 36%, 21% and 13% of the total investment respectively.

Of the total investment, almost 54% is invested within the first year of planting (Figure 2). The balance is split according to 12%, 9%, 8%, 8% and 9% during the 2<sup>nd</sup>, 3<sup>rd</sup>, 4<sup>th</sup>, 5<sup>th</sup> and 6<sup>th</sup> years respectively.

The distribution of the cost of immature upkeep by labour and material according to age of the crop is given in Table 2. In the 1<sup>st</sup> year, expenditure on labour accounts for 87% of the total investment and thereafter it gradually declines to about 64% in the 6<sup>th</sup> year. On the contrary, the material cost increases from 13% to 36% for the same period.

Figure 3 shows the distribution of labour according to year of planting. The requirement of labour during the 1<sup>st</sup> year is nearly 60% (730 man days) of the total labour requirement of the immature period. The 2<sup>nd</sup> year onwards the demand for labour gradually declines to around 100 (80-135) man days per year.

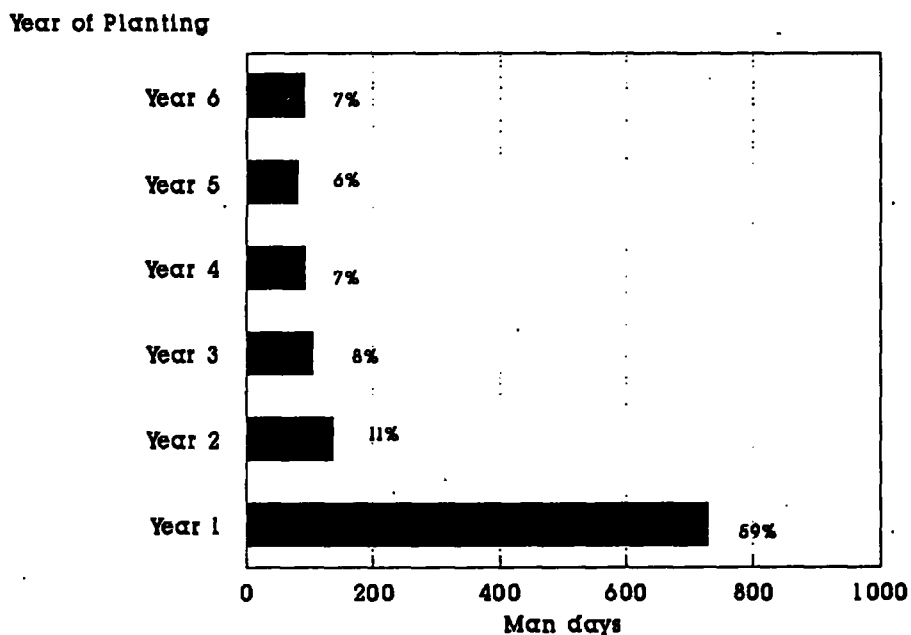


Fig. 3. Distribution of mandays during immature upkeep by year of planting

Table 1. Cost of Immature Upkeep [Year 1-6] for Replanting of Rubber (Rs/ha at 1994 prices)

ACTIVITY	LABOUR USAGE									MATERIAL USAGE										LABOUR + MATERIAL COST						
	No. of Mandays*							Total Cost		Unit	Unit Cost Rs	No. of Units*						Total Cost		Rs	%					
	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Total	Rs	%			Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Total	Rs			%				
Uprooting and Clearing	327.5						327.5	27,183	26.59														27,183	20.98		
Removal of Fomes Patches	12.5						12.5	1,037.5	1.02															1,037.5	0.80	
Lining	7						7	581	0.57															581	0.45	
Drains and Silt Pits	40					10	50	4,150	4.06															4,150	3.20	
Terracing	10						10	830	0.81															830	0.64	
Holing	63						63	5,229	5.12															5,229	4.04	
Filling Holes	33						33	2,739	2.68															2,739	2.11	
Planting	33						33	2,739	2.68	plant	8	500										500	4,000	14.64	6,739	5.20
Cover Establishment	7.5						7.5	622.5	0.61	kg	90	5										5	450	1.65	1,072.5	0.83
Cover Fertilizer (IRP)	3	3					6	498	0.49	kg	4.5	225	150									375	1,688	6.18	2,186	1.69
Fertilizer - IRP										kg	4.5	50										50	225	0.82	225	0.17
- U 12:14:14	10	10	7.5	7.5	7.5	7.5	50	4,150	4.06	kg	5.7	162.5	275	400	400	550	550	2,337.5	13,325	48.77				17,475	13.49	
- Kieserite										kg	10	50										50	500	1.83	500	0.39
- Dolomite		2.5	2.5	2.5	2.5	2.5	12.5	1,037.5	1.02	kg	0.8		75	100	100	125	125	525	420	1.54				1,457.5	1.13	
Supply Vacancies	3	2					5	415	0.41	plant	20	50	25									75	1,500	5.49	1,915	1.48
Weeding	172	108	84	72	60	60	556	46,148	45.15																46,148	35.63
Shoot Cutting		2.5	2				4.5	373.5	0.37																373.5	0.29
Pest & Disease Control	8	8	8	8	8	8	48	3,984	3.90		100	1	1	1	1	1	1	6	600	2.20				4,584	3.54	
Girth Census & Numbering				2	2	2	6	498	0.49	gal	75			0.5	0.5	0.5		1.5	113	0.41				611	0.47	
Tools										set	750	1	1	1	1	1	1	6	4,500	16.47				4,500	3.47	
Total Mandays (Annual)	729.5	136	104	92	80	90	1,231.5																			
Total Cost	60,549	11,288	8,632	7,636	6,640	7,470	102,215	102,215	100.00			8,964	3,653	3,210	3,248	4,123	4,123		27,321	100.00						
Total Labour + Material Cost												69,513	14,941	11,842	10,884	10,763	11,593		129,536					129,536		
Grand Total																								129,536	100.0	

Calculated on the basis of Annexes 01 and 02

## Cost per tree

The investment per tree for the entire immature period (*ie* from year 01 to 06) is approximately Rs.260 (Table 3). A plant density of 500 trees per hectare is assumed in arriving the above figure.

Table 2. *Distribution of cost of immature upkeep by labour and material according to tree age (Rs/ha)*

Tree Age (Years)	No of Labour Units <sup>1</sup>	Labour Cost <sup>2</sup>	Material Cost <sup>3</sup>	Total Cost
1	729.5	60,549 (87%)	8,964 (13%)	69,513 (100%)
2	136	11,288 (76%)	3,653 (24%)	14,941 (100%)
3	104	8,632 (73%)	3,210 (27%)	11,842 (100%)
4	92	7,636 (70%)	3,248 (30%)	10,884 (100%)
5	80	6,640 (62%)	4,123 (38%)	10,763 (100%)
6	90	7,470 (64%)	4,123 (36%)	11,593 (100%)
Total	1231.5	102,215 (79%)	27,321 (21%)	129,536 (100%)

<sup>1</sup> See Annex 02

<sup>2</sup> @ Rs 83/= per labour unit

<sup>3</sup> See Annex 02 and Annex 03

Table 3. *Average cost per tree by age*

Age (year/s)	Average Cost (Rs/tree/year)
1	139.03
2	29.88
3	23.68
4	21.77
5	21.53
6	23.19
Total	259

## Labour Requirements for Uprooting and Clearing of Rubber Lands (Labour Units/ha)

ACTIVITY	RATE OF LABOUR USAGE	No OF LABOUR UNITS
1. Felling of old rubber trees	@ 6 trees/labourer for 255 trees/ha (85% of existing stand of 300 trees)	42.5
2. Removal of stumps	@ 2 stumps/labourer for 45 stumps/ha (15% of existing stand of 300 trees)	22.5
3. Cutting and stacking of firewood	@ 2 firewood yrds/tree, 510 yrds of firewood/ha from 255 trees: @ 3 firewood yrds/labourer for 510 yrds	170.0
4. Removal of roots		
A) Digging of roots	@ 6 roots/labourer for 255 tree roots/ha	42.5
B) Removal of earth + cutting of laterals	@ 14 roots/labourer for 300 roots/ha	21.4
C) Stacking of roots	@ 15 roots/labourer for 300 roots/ha	20.0
D) Burning of roots	@ 35 roots/labourer for 300 roots/ha	8.6
Total No of mandays needed for uprooting and clearing		327.5

Assumptions: The initial stand = 500 trees/ha  
Stand at uprooting = 60% of initial stand

## Labour and Material Requirements during Immature period (Year 1-6)

TYPE OF OPERATION/INPUT	REMARKS
1. Uprooting and Clearing:      ◊	see Annex 01
2. Removal of Fomes Infected Patches:	@ 12.5 labourers/ha for demarcation of infected area, digging out Fomes infected patches and application of sulphur, assuming an infected area of 10% of holes
3. Lining:	@ 75 holes/labourer for 500 holes (includes lining for drains and terraces
4. Drains and Silt Pits:	@ 40 labourers/ha to re-cut old drains and cut new drains where required
5. Terracing:	@ 10 labourers/ha (includes construction of silt traps and contour terracing where required)
6. Holing:	@ 8 holes/labourer for 500 holes
7. Filling Holes:	
A) Material (Basal Mixture)	50g U12:14:14 + 100g Rock phosphate + 25g Kieserite per plant mixed with top soil, applied 2-3 weeks prior to planting x 500 holes
B) Labour	@ 15 holes/labourer for 500 holes
8. Planting:	@ 15 plants/labourer; assuming the use of bare root plants for replanting for 500 plants
9. Cover Establishment:	
A) Material	5kg of Pureria seeds/ha) + 75kg of Rock Phosphate (IRP)/ha
B) Labour	@ 7.5 labourers/ha for preparing beds and putting out seeds

TYPE OF OPERATION/INPUT	REMARKS
<p>13. Weeding:</p> <p>1<sup>st</sup> year</p> <p>2<sup>nd</sup> year</p> <p>3<sup>rd</sup> year</p> <p>4<sup>th</sup> year</p> <p>5<sup>th</sup> year</p> <p>6<sup>th</sup> year</p>	<p>8 rounds: initial round: @ 62 labourers/ha</p> <p>2<sup>nd</sup> round: @ 30 labourers/ha</p> <p>3<sup>rd</sup> round: @ 20 labourers/ha</p> <p>4<sup>th</sup> to 8<sup>th</sup> rounds: @ 12 labourers/ha/round</p> <p>12 rounds: @ 9 labourers/ha/round</p> <p>12 rounds: @ 7 labourers/ha/round</p> <p>12 rounds: @ 6 labourers/ha/round</p> <p>12 rounds: @ 5 labourers/ha/round</p> <p>12 rounds: @ 5 labourers/ha/round</p>
<p>14. Shoot Cutting:</p>	<p>2<sup>nd</sup> year: @ 2.5 labourers/ha</p> <p>3<sup>rd</sup> year: @ 2 laborers/ha</p>
<p>15. Pest &amp; Disease Control:</p> <p>A) Material</p> <p>B). Labour</p>	<p>Rs 100/= per ha per year for chemicals</p> <p>@ 8 labourers/ha/year</p>
<p>16. Girth Census and Numbering of Trees:</p>	<p>4<sup>th</sup> year: @ 1 labourer/ha for girth census and for numbering of trees</p> <p>5<sup>th</sup> and 6<sup>th</sup> years: 2 rounds of girth census/year; @ 1 labourer/round</p>

TYPE OF OPERATION/INPUT	REMARKS
10. Cover Fertilizer: A) Material B) Labour	150kg of Rock phosphate (IRP)/ha/year in the first two years @ 3 labourers/ha/year
11. Rubber Fertilizer: A) Material B) Labour	during the 1 <sup>st</sup> year: 275g of U12:14:14 mixture/plant in 4 applications and 75g of Kieserite/plant to be applied with one application of U12:14:14 mixture x 500 plants during the 2 <sup>nd</sup> year: 550g of U12:14:14 mixture/plant in 4 applications and 150g of Dolomite/plant in one separate application x 500 plants during the 3 <sup>rd</sup> and 4 <sup>th</sup> years: 880g of U12:14:14 mixture/plant/year in 3 applications and 200g of Dolomite/plant/year in one separate application x 500 plants from 5 <sup>th</sup> year until tapping: 1100g of U12:14:14 mixture/plant/year in 3 applications and 250g of Dolomite/plant/year in one separate application x 500 plants @ 2.5 labourers/ha per application
12. Supply Vacancies: A) Material B) Labour	10% in the 1 <sup>st</sup> year and 5% in the 2 <sup>nd</sup> year; assuming the use of poly bag plants to fill the vacancies @ 15 plants/labourer

TYPE OF OPERATION/INPUT	REMARKS
17. Tools:	a set of basic tools used in upkeep of rubber
18. Cost of Fencing:	not included in the study
19. Cost of Maintenance of Existing Roads and Cutting of New Roads:	not included in the study
20. Cost of buildings : Factory, offices, workshops, housing	not included in the study
21. Cost of machinery (in the factory)	not included in the study
22. Cost of vehicles (Trucks, tractors, trailers, etc.)	not included in the study

## A Summary of Input Prices

TYPE OF INPUT	UNIT COST (Rs)
1. Planting material	
- bare root plants	8.00/plant
- poly bag plants	20.00/plants
2. Pueria seeds	90.00/kg
3. Fertilizers	
- Imported Rock Phosphate (IRP)	4.50/kg
- U 12 : 14 : 14	5.70/kg
- Kieserite	10.00/kg
- Dolomite	00.80/kg
4. Chemicals for pest and disease control	
- Sulphur	100.00/ha/year
- Mixture of Brunolium and Red powder	500.00/ha/year