

ECONOMICS OF INTERCROPPING TEA AND RUBBER

01. The first TRI Circular on intercropping tea and rubber is under issue. Coinciding with it, this paper sets out the preliminary economics of this activity.

02. Given the agronomical feasibility, interplanting of the two major plantation crops has the following advantages:

- Areas with marginal soil conditions can be put to better use through multi-cropping
- For small holders, in particular, the dependence can be mitigated to some extent by the income from two sources.
- The activity generates a revenue income from both the crops as well as a capital receipt from the sale of rubber trees; to that extent, the latter element will help to partly offset the replanting cost to be incurred during the subsequent cycle(s).

The only other country with large-scale interplanting of tea and rubber is China where rubber trees are used more as wind belts than for latex extraction. Since the concept is relatively new in Sri Lanka, the field practices will undergo constant review and upgradation; and, so will the economics of the operation.

03. Annexure A summarises the cost of the two-tier activity. This is based on the joint TRI/RRI studies that the most suitable crop combination in the low country is where rubber is planted at 12m x 2.4m (40ft x 8ft) and 7 rows of tea (1.2m x 0.6m) are

accommodated in between 2 rows of rubber planted 12m apart. This works out to a 70 per cent tea stand and 75 per cent of rubber as respective monocrops and involves the planting of 9,375 tea bushes and 341 rubber trees. Both the operations are assumed to be commenced and undertaken simultaneously which is reportedly possible by digging trenches alongside the young rubber plants to prevent their roots from spreading to tea areas; this has the advantage of cutting back on the immaturity period for rubber as the planting can be done to coincide with the rehabilitation of the tea field instead of the earlier practice of rehabilitation to be completed and to plant both tea and rubber thereafter around the same time. Further, the revised recommendation is for the use of rubber clones with erect growth habits - RRIC 100, RRIC 102 and RRIC 121- which, apart from minimising the excess shade, is not expected to adversely affect yield from tea. As will be seen, the cost of the integrated activity totals about Rs 241,000 per hectare. This is a general statement and is derived from estates which have undertaken this operation and also incorporates the data available with the TRI and RRI. Essentially, the following aspects may be noted:

- The cost is exclusive of overheads.
- Labour accounts for 63 per cent of the cost and, as noted in the earlier papers, this component will in effect be lower where surplus labour exists.
- The proportionate share as among tea, rubber and common operations is roughly in the ratio of 15:6:4.

04. Table 1 gives the revenue side of the activity. Because of the longer gestation involved, the income from rubber will, in spite of the earlier planting, take more years to accrue than tea. An important assumption - this is based on preliminary field trials by RRI - is that the joint cropping does not necessarily bring about any statistically significant difference either in the growth of the rubber tree or in tea yield compared to monocrop cultivation. The cost of conversion of green leaf into made tea is taken at Rs 13 per kg while that for latex to sheet and scrap rubber is placed at Rs 5 per kg. Alongside, the NSA for tea is taken to be Rs 70 per kg and for rubber Rs 60 per kg. On this basis, and at a discount rate of 15 per cent, it is seen that investment, particularly in the light of the current bouyancy in rubber prices and a sale value of old rubber trees at Rs 67,500 per hectare (Rs 300 per tree * 225 trees) at the end of the cycle, will generate a Net Present Value (NPV) of Rs 27,090 and break even in the 12th year. Some of these parameters, especially the price realisation, can be varied through sensitivity analysis, but the overall position is unlikely to undergo a significant change..

06. For the purpose of Table 1, the data on the cost of upkeep of the mature intercropped area has been derived from a number of sources. Principally, they relate to estates which are already undertaking this activity but since the accounts are not maintained separately for the integrated activity, we have gone by an approximation and the details are presented in Annexure B

TABLE 1-Returns from Tea and Rubber Interplanting (Rs/ha)

Activity	Yr 1	Yr 2	Yr 3	Yr 4	Yr 5	Yr 6	Yr 7	Yr 8	Yr 9	-	Yr 25
Capital Cost	73345	20211	79988	33131	24096	10244					
Tea Yield (Kg M.T)							910	1120	1575	-	1575
Rubber Yield (Kg/Latex & Scrap)							900	900	900	-	900
Cost of Mature Interplanting upkeep							33200	33200	33200	-	33200
Plucking + Manufacturing cost							39137	45768	60481	-	60481
Rubber Manufacturing Charges							4500	4500	4500	-	4500
Total Cost	73345	20211	79988	33131	24096	10224	76837	83468	98181	-	98181
Returns from Tea (NSA at Rs 70/kg)							63700	78400	110250	-	110250
Returns from Rubber (NSA at Rs 60/kg)							54000	54000	54000	-	104625
Total Returns							117700	132400	164250	-	214875
Total Net Returns	-73345	-20211	-79988	-33131	-24096	-10224	40863	48932	66069	-	116694
Net Present Value (at 15% D.R)	24459										

Assumptions

1. Tea yield (Kg M.T) taken at 70 per cent of 1300,1600 per hectare for 1st and 2nd year respectively and 2250 from third year onwards
2. Rubber yield taken at 75 per cent of 1200 kg per hectare from 7th year onwards
3. Cost of mature interplanting upkeep as per the Annexure B
4. Plucking cost calculated using AEU study on Labour Planning on Estates
5. Manufacturing cost of tea taken at Rs 13 per kg M.T
6. Rubber manufacturing charges taken at Rs 5 per kg
7. Cost and returns constant from year 9 except the value of old rubber trees no (225*.75) @ Rs 300 (Rs 50625) added to the rubber gains in year 25

which places the cost of upkeep at Rs 33,200 per hectare. In doing so, land based activities such as road and boundries, terracing etc., have been fully provided for only in tea.

07. In the costing of the operation for small holdings, two aspects have to be taken into consideration - firstly, the wage difference that exists between the estate and small sector, and, secondly, the subsidy that can be availed of by small holders at Rs 46,465 per hectare under the pilot scheme for intercropping tea and rubber, as per the following schedule:

Activity	Subsidy (Rs/ha)
Uprooting	1488.40
Soil Conservation	6000.00
Planting tea/rubber,	17674.60
Maintenance tea/rubber	7712.30
Maintenance rubber	2594.55
Maintenance rubber	2594.55
Maintenance rubber	2594.55
Maintenance rubber	2594.55
Maintenance rubber	3212.30
Total	46465.80

On the revenue side as well, two changes relating to small holdings have been incorporated; firstly, that, in tea, it is limited to the realisation from the sale of green leaf at Rs 9.85 per kg, and secondly, that, in rubber, a relatively lower price of Rs 55 per kg is estimated. On this basis, Table 2 projects the returns from the operation and while a positive NPV is generated, it is of a lower extent than in the estate sector. This factor, as noted in the paper on Infilling, is mainly because of the higher margin which accrues in tea at the factory level on the assumed levels of NSA and variable manufacturing cost.

08. Although the analysis is suggestive of a positive return from the intercropping of tea and rubber, it would be premature to propose an investment decision to estates and small holdings. More field trials on the technical compatibility of the dual activity are required to be undertaken apart from having to obtain a better insight into the costs and revenue from it. This paper has attempted a beginning on the latter aspect and it is our intention that studies in this regard will be stepped up shortly.

TABLE 2-Returns from interplanting for small holdings (Rs/ha)

Activity	Yr 1	Yr 2	Yr 3	Yr 4	Yr 5	Yr 6	Yr 7	Yr 8	Yr 9	-	Yr 25
Capital Cost	65655	18114	74147	30504	22391	9164					
Tea Yield (Kg green leaf)							3957	4870	6848	-	6848
Rubber Yield (Kg/Latex & Scrap)							900	900	900	-	900
Cost of Production of Tea Small Holdings							30663	37739	53071	-	53071
Cost of Production of Rubber Small Holdings							14460	14460	14460	-	14460
Rubber Manufacturing Charges							4500	4500	4500	-	4500
Total Cost	65655	18144	74147	30504	22391	9164	49623	56699	72031	-	72031
Returns from Tea (Green leaf price Rs9.85/kg)							38972	47965	67451	-	67451
Returns from Rubber (NSA at Rs 55/kg)							49500	49500	49500	-	100125
Subsidy for Small Holdings	1488	6000	17674	7712	2594	2594	2594	2594	3212		
Total Returns	1488	6000	17674	7712	2594	91066	100059	120163	116951	-	167576
Total Net Returns	-64167	-12114	-56473	-22792	-19979	-6570	41443	43360	48132	-	95545
Net Present Value (at 15% D.R)	16449										

Assumptions

1. Tea yield (Kg green leaf) taken at 70 per cent of 5562 and 6956 per ha for the 1st and 2nd year respectively and 9782 from third year onwards
2. Made tea to green leaf conversion taken at 100/23
3. Rubber yield taken at 75 per cent of 1200 kg per ha from 7th year onwards
4. Cost of production of small holder tea taken at Rs 7.75 per green leaf kg as per MPI estimate
5. Cost of production of small holder rubber taken at Rs 19280 per ha with same labour usage as in estate sector
6. Daily wage of Rs 71.48 inclusive of EPF/ETF has been taken, being the statutorily applicable rate for private estate owners
7. Rubber manufacturing charges taken at Rs 5 per kg
8. Cost and returns are constant from year 9 except the value of old rubber trees no (225*.75) @ Rs 300 (Rs 50625) added to the rubber gains in year 25

ANNEXURE A. TEA AND RUBBER INTERPLANTING COST (70% OF TEA STAND WITH 75 % OF RUBBER)

(Rupees per hectare at 1994 prices)

Operation	Labour Utilization							Material Utilization							Overall Cost			
	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Total Mandays	Total Cost	Unit	Unit Cost	Year 1	Year 2	Year 3	Year 4		Year 5	Year 6	Total Cost
	(Mandays)										(Units)							
Survey							1000										1000	1000
Uprooting (Tea)	172						172	14276										14276
Forking and Levelling	75						75	6225										6225
Dolomite	6						6	498	kg	0.8	2000						1600	2098
Planting Grass	37						37	3071										3071
Planting Shade (Medium)	22						22	1826	Pole	0.5	540						270	2096
Grass fertilizer (U 625)	3	11					14	1162	kg	6	120	232.5					2115	3277
Grass Lopping & Thatching	48	60					108	8964										8964
Trenches (Rubber)	20						20	1660										1660
Lining and Pegging (Rubber)	3						3	249										249
Holing (Rubber)	34						34	2822										2822
Foam Patches (Rubber)	8						8	623										623
Planting (Rubber)	22						22	1826	plant	28	341						9548	11374
Clearing Mana Grass			37				37	3071										3071
Lining and Pegging (Tea)			37				37	3071										3071
Holing (Tea)			105				105	8715										8715
Filling Holes (Tea)			23				23	1909										1909
Planting (Tea)			88				88	7304	plant	3			9375				28125	35429
Thatching			70	70			140	11620										11620
Shade Lopping and Green Manure		25	25	15	15		95	7885										7885
Weeding (Tea + Rubber)	93	63	50	67	64	56	393	32619										32619
Cover Crop (Pueraria)	5						5	415	seed (kg)	90	4						360	775
Cover Crop Fertilizer (Saposh P)	6						6	498	kg	4.5	75						338	836
Rubber Fertilizer (U/12:14:14)	10	8	8	8	8	8	50	4150	kg	5.7	378	378	378	378	269	269	11685	15835
Tea Fertilizer U-195			15	21			36	2988	kg	7.5			873	1087			14700	17688
Tea Fertilizer U-599					17		17	1411	kg	7.6					1029		7820	9231
Dolomite (Rubber)		1	1	1	1	1	5	415	kg	0.8		68	68	68	68	68	272	687
Resupplying Tea				13	13		26	2158	plant	3				940	468		4224	6382
Resupplying Rubber	3	3	1				7	581	plant	28	34	17					1428	2009
Centering (Tea)			7	7	8		22	1826										1826
After Care (Rubber+Tea)	1	1	1	1			4	332										332
Roads and Bridges	17	4	5	3	3		32	2656										2656
Drains and Silt Pit	38		20	12	12	5	87	7221										7221
Terracing	45	3	3	3	3	3	60	4980										4980
Ravine and Boundries			5	5	2	2	14	1162										1162
Pest & Diseases		2	5	2	2	2	13	1079	kg	0.25		100	100	100			75	1154
Shoot Cutting (Rubber)	1		1				2	166										166
Tools									tools	1000	1	1	1	1	1	1	6000	6000
Total Mandays	668	182	507	228	148	92	1825	151434									89560	
Annual Cost	55403	15106	42081	18924	12284	7636		151434			17942	5105	37907	14207	11812	2588		
Annual (Labour +Material) Cost											73345	20211	79988	33131	24096	10224	240993	
Grand Total																		240993

Assumptions

- No general charges included
- Resupplying tea assumed 10% in first year and 5% in second year from the initial stock
- Tea Fertilizer application: U-195 1165kg/ha in 1st year and 1553 kg/ha in 2nd year from third year till pruning U-599 1372 kg/ha/yr (in 100% stand)
- Rubber fertilizer application R 12/14/14 1125gm/plant/year up to 4th year and 800gm/plant/year onwards
- Rubber spacing 40*8(ft) and tea spacing 4*2(ft) allowing 336 rubber trees and 9375 bushes of tea
- Tea uprooting at the rate of 25 bushes per worker, 50% of 8600 bushes per hectare
- Weeding labour apportioned using physical land area (30% for rubber and 70% for tea) for each crop.
- Medium shade establishment for 70% tea area numbering 90 shade trees
- Field practices and cost correspond to those at Panawatte Estate and Pusellawa group

ANNEXURE B, ANNUAL AVERAGE COST OF UPRKEEP OF MATURE INTERPLANTED AREA (TEA & RUBBER) (Changes per Hectare at 1994 Prices)								
Operation	Labour		Unit	Material		Total Cost	Percent	
	Mandays	Cost		Unit Cost	Quantity			Cost
Tools			set	750	1	750	2	
Roads & Bridges	3	249				249	1	
Desilting & Trace Drains	11	913				913	3	
Terracing	4	332				332	1	
Weeding-Hand	25	2075				2075	6	
Weeding-Chemical								
Labour	10	830				830	2	
Gramoxone			liter	207	4	828	2	
Couch Grass Eradication								
Labour	2	166				166	0	
Roundup			liter	1700	0.50	850	3	
Ravines & Boundaries	2	166				166	0	
Pruning	8	664				664	2	
Rain Guards (25% of extent of Rubber)	9	747	Rain Guard	8	85	680	4	
Shade Management	7	581				581	2	
Bush Sanitation	4	332				332	1	
Storm Damage (Rubber)	2	166				166	0	
Artificial Manure								
Dolomite	6	498	kg	0.80	200	160	2	
U 709 (Mature tea mixture)	11	913	kg	6.70	645	4322	16	
R/12,14,14(Mature rubber Mixture)								
Kieserite (Rubber)			kg	10.00	20	200	1	
Blister Blight Control	7	581	mix	212	1.40	297	3	
Pest and Disease (Rubber)	2	166				166	0	
Brunolium			bottle	300	0.75	225	1	
Red powder			kg	160	0.75	120	0	
Marking (Rubber)	2	166				166	0	
Census (Rubber)	2	166				166	0	
Tapping	150	12450				12450	37	
Tapping utensils			set	1500	0.75	1125	3	
Anticoagulant (Sodium sulphate)			kg	36	1.50	54	0	
						33200	100	
Total	270	22610				10790	33200	100

Assumptions

1. Fertiliser application for as per TRI recommendation (992 kg of U 709 at 2000-2500 kg M.T. yield/ha/year)
2. Plucking and manufacturing cost of tea not included
3. Tapping of rubber with S/2 D/2 system at 100% intensity and 225 tapable days
4. Mature rubber yield taken to be 1200 kg (latex + scrap) from year 7
5. Blister control by mixture of fungicides
6. Field operations taken as intergrated activity
7. Tapping Utensil per hectare as follows:
 - Spout 500 @ Rs.-/40
 - Coconut Shells 600 @ Rs-/25
 - Tapping Knives 2 @ Rs45/-
 - G/I Buckets 2.5 Gal @ Rs330/-
 - Collecting Buckets small 2 @ Rs220/-
 - Anticoagulant @ 125 gm/100kg of latex

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