Tea Bull., **16**(1&2) 16-22 , 1999

COST-BENEFIT OF SHADE MANAGEMENT IN TEA

B. Sivaram and G. Ganewatte

(Consultant and Research Assistant respectively, Agricultural Economics Unit, Tea Research Institute of Sri Lanka, Talawakelle, Sri Lanka)

The debate, bordering controversy, on the value or otherwise of having shade trees in tea plantation has become more or less academic. The detrimental effects of their removal having been conclusively proved, the industry is now engaged in an ongoing programme of restoring shade not only in new clearings but also in plucking fields after pruning. The objectives are three-fold -- first, providing shade to the crop and soil and reducing temperature of the ambient air and soil; second, generating green manure through leaf fall and lopping; and, third, affording shelter from winds and reducing transpiration losses. This note attempts to highlight some of the economic aspects connected with this operation.

In accordance with TRI recommendations and the practices currently followed in the industry, the cost of establishing the recommended combination of high and medium shade trees in pruned tea fields in the up and mid-country is estimated at Rs 6034.55 per hectare. The break-up is given in Table 1.

Table 1 - *Cost of Establishing Shade Trees (Rs/ha)*

Type	Labour	Plants	Materials	Total Cost
High Shade (Grevillea robusta)	12 mandays (@Rs 99.65)	70 (@ Rs 3.00 per plant)	Dolomite 1 kg (@ Rs 2.10 per plant) Plant Cover (@ Rs 5.00 per plant)	
	[Rs 1195.80]	[Rs 210.00]	[Rs 497.00]	**Rs 1902.80**
Medium Shade (Dadap)	35 mandays (@Rs 99.65)	160 (@ Rs 1.50 per plant)	Dolomite 0.25 kg (@ Rs 2.10 per plant) Liming (@ Rs 2.00 per plant)	
	[Rs 3487.75]	[Rs 240.00]	[Rs 404.00]	**Rs 4131.75**
		Total		**Rs 6034.55**

Based on TRI findings, the average life span for *Grevillea* and Dadap has been taken at 30 and 15 years respectively. It is estimated that, after the gestation period, *Grevillea* generates 75 per cent of the nutrient value from leaf fall from the fifth to the tenth year and the full amount thereafter. Pollarding of *Grevillea* is to be undertaken in or about the eleventh year after planting. This involves about 15 man days per hectare. After that and until the life of the tree, about 3 man days are annually required for maintaining the shade at the desired level. However, since the leaf fall occurs naturally, no cost has to be attached to this feature. With regard to Dadap, the full loppings from it become available from the fourth year. Two such loppings are possible annually for which 10 man

days are estimated. The average maintenance cost, therefore, is about Rs 997.00 per hectare. A further element relates to the uptake of nutrients by shade trees which has been placed by some researchers at 5 per cent of the fertiliser that usually goes into the tea field. At current cost, this works out to Rs 950.00 per hectare per annum.

As noted earlier, the principal gain accruing from shade tree is that it enriches the soil by adding organic matter. While *Grevillea* annually generates 5 to 8 tons of mulch per hectare through biomass leaf litter, Dadap furnishes around 15 tons of loppings. These benefits have been quantified in Table 2 based on the nutrient content in the leaf matter of these two species and their value calculated at the prices prevailed in December 1997.

Table 2 - *Benefits* through *Addition of Organic Matter - Up and Mid Elevation (Rs/ha/Year)*

Type	Nutrient	Kg	Unit Value of Nutrients (Rs/kg)	TotalValue (Rs)
Grevillea robusta	Nitrogen	28.4	15.23	432.53
	Phosphorous(P_2O_5)	4.2	13.23	55.56
	Potassium (K_2O)	22.8	21.83	497.72
	Magnesium (MgO)	4.5	69.79	314.05
Erythrina lithosperma (Dadap)	Nitrogen	136.5	15.23	2078.89
	Phosphorus (P_2O_5)	26.8	13.23	354.56
	Potassium (K_2O)	78	21.83	1702.74
	Magnesium (MgO)	14	69.79	977.06
			Total	**Rs 6413.11**

(Source: Soil and Plant Nutrition Division/TRI)

Another element, being in the nature of a capital receipt, is the value of fuel wood that can be obtained from the felling of *Grevillea* at the end of its life span. On the assumption that each tree yields about 3 cubic metres of fuel wood, the estimated income at current realisation could be as much as Rs 126,000 per hectare.

Although not a fully controlled study, a relatively recent analysis carried out under the aegis of the Upper Mahaweli Watershed Management Project is suggestive of a higher yield under shaded field conditions. In respect of the up-country, it is reported that loppings of Dadap could increase yield by 60 kg per hectare or 4 per cent, as was evidenced in the Udapussellawa region. If this position is accepted, it results in a higher gross margin (current price realisation less cost of fertiliser, plucking and manufacture) of about Rs 25 per kg or Rs 1500 per hectare. Equally significant is that, as per Tocklai findings going back to 1958, shade was found to improve the quality of the made tea -- a claim that has been corroborated in Kenya 30 years later.

Reference may also be made to certain allied issues connected with shade trees, both positive and negative, the former far exceeding the latter. The only possible negative aspect is that control of Blister Blight is better achieved in unshaded fields. On the other hand, the positive attributes are several and far reaching and also have off-site effects. These include, among others, less soil erosion, build up of soil organic matter, improved water holding capacity and scope for biological control of pest.

In assessing the economic impact of establishing shade trees, it will be evident that the cost involved, both on the investment and recurring accounts, can be easily quantified. The problem, however, is in placing a monetary value to the gains accruing from this activity. This is because unlike, for example, replanting or infilling which generates an estimated revenue by way of higher yield and/or improved price realisation, such a value cannot always or necessarily be placed in converting the nutrient gain which

improved shade management entails. All the same and in an effort to highlight the implications over a 30 year period - one cycle of *Grevillea* and two of Dadap -, we have annualised the cost-benefit of the quantifiable elements and have also summarised the non-quantifiable features. These are presented in Table 3 which amply demonstrates the overall gains accruing to estates and smallholders by undertaking this activity on a sustained basis.

Table 3 - *Overall Cost and Benefits of Shade Management (Rs/ha/year)*

Cost	Rs	Benefit	Rs
Quantifiable			
Establishment cost	338.00	Addition of Organic Matter	3106.00
Shade Management	996.00	Fuel Wood Value	4200.00
Fertilizer Uptake	440.00		
Gain	5532.00		
Total	7306.00		7306.00
Non - Quantifiable			
Blister - Blight Occurance		Pest and Disease Control Quality Improvement Less Soil Erosion Build Up of Soil Organic Matter Increased Water Holding Capacity	

In adapting these approaches to the low-country situation, it is to be noted that *Gliricidea* is recommended instead of Dadap. Also, the use of *Albizia* is more widespread in the region. *Gliricidea* annually generates 20 tons of mulch per hectare through biomass leaf litter whereas Albezia spp. furnishes around 5 to 6 tons of loppings While there is no significant change in the cost of establishment and maintenance, the nutrient gain from the leaf fall and the loppings is of a higher order and to that extent, the beneficial impact of shade is greater than in the up and mid elevations. Table 4 gives the comparative position.

Table 4 - *Benefits through Addition of Organic Matter - Low Elevation (Rs/ha/Year)*

Type	Nutrient	Kg	Unit Value of Nutrients (Rs/kg)	Total Value (Rs)
Albizia moluccana	Nitrogen	41.3	15.23	628.99
	Phosphorous(P_2O_5)	5.3	13.23	70.11
	Potassium (K_2O)	10.3	21.83	224.84
	Magnesium (MgO)	5.0	69.79	348.95
Gliricidia sepium	Nitrogen	159.6	15.23	2430.70
	Phosphorus (P_2O_5)	19.2	13.23	254.01
	Potassium (K_2O)	96.8	21.83	2097.42
	Magnesium (MgO)	22.0	69.79	1535.38
			Total	**Rs7590.40**

[Source: Soil and Plant Nutrition Division/TRI]

Because of the higher ambient temperature and the consequent need to maintain micro-climatic condition at the desired level, the role of shade in the low elevation is of greater relevance. This aspect assumes particular significance in the light of recent forecast that Carbon Dioxide (CO_2) enrichment and the resultant global warming will be more pronounced in future in the low-country than hitherto.

The overall position, therefore, is that, taking into consideration the addition to organic matter as also the other and non-quantifiable gains, the restoration of shade in all the elevations will go a long way in ensuring sustainable agriculture in tea. Its importance in the emerging Sri Lankan tea scenario can hardly be over-emphasised.

As fertiliser subsidy was changed several instances in the year 1997, prices taken for valuation do not reflect reality prevailed in the market during the year. Therefore, the actual value of the benefits generated would be much higher than the given estimates.

REFERENCES

ANON (1958) *Annual Report - Tocklai Expt. Stan.*

KATHIRAVETPILLAI, A. (1985) Aspects of shade tree question. *Tea Bull.* **5(1&2):** 36 - 44.

LEGG, N.T. (1994) An economic analysis of the use of multipurpose tree species in tea production with reference to land use ratios. *Proceedings of fifth Regional Workshop on Multipurpose Tree Species*. 113 - 127.

MURTHY, S.B.K. (1996) Shade in tea plantations. *The Planters' Chronicle* **91:** No 12, 591 - 595

OWUOR, P.O. and OTHIENO, C.O. (1988) Studies on the use of shade in tea plantations in Kenya : Effects on chemical composition and quality of made tea. *J Sci Food Agri.* **46** : 63 - 70.

SIVAPALAN, P. (1993) Shade and green manure trees in tea - a holistic appraisal. *SLJ of Tea Sci* **62:** 41 - 46.

WIJERATNE, M.A. (1996), Vulnerability of Sri Lankan tea production to global climate change, *Water, Air and Soil Pollution* **92** : 84 - 94.