MULCHING WITH PADDY STRAW : TO REDUCE IMMATURITY AND IMPROVE YIELDS

Lalani Samarappuli

During the early years after planting, the young rubber plants provide very little protection to the soil. This is due to the poor canopy cover and inadequate growth of ground cover crops. It is therefore necessary to adopt suitable practices that would provide sufficient ground cover during the early stages of the growth.

In this regard, growing of leguminous cover crops may be beneficial. Yet, most of the legume covers take at least 6 to 12 months to provide a sufficient protection to the soil. Legumes may also compete for moisture and some nutrients with rubber plants resulting in the retardation of growth in addition to their detrimental effects in causing evapo-transpiration losses.

In considering the above aspects, dead mulch is considered to be much more beneficial than growing legumes. In addition to its ability to contribute nutrients and conserve moisture, dead mulch does not compete with rubber for nutrients and moisture. Moreover, mulching had been found to be very effective in avoiding evapo-transpiration losses and in controlling soil erosion. Mulching has another advantage in that it could be done immediately after planting, as mulching materials can easily be obtained at the same time.

Among the plant residues, rice straw is particularly of importance as it is rich in potassium and also contains a certain amount of other plant nutrients. Moreover, burning of large quantities of straw in the paddy fields every year, besides causing loss of valuable nutrients and organic matter, can also cause serious atmospheric pollution and health hazard problems. Insufficient attention has been paid in the past in finding suitable methods to enhance the efficiency of rice straw as a mulching material.

Experimental results available at the RRISL have shown that mulching with paddy straw can be a cost-effective agronomic practice in enhancing the growth of immature *Hevea*. Growth of *Hevea* as assessed by measuring tree girth indicated that the trees in mulched plots were superior to the trees in legumes and natural plots (Fig. 1). Better growth during immaturity resulted in higher rate of tappability of the rubber plants at the end of 6 years (Table 1).

Table 1. *Effect of different soil management practices on tappability (%) of rubber plants at the end of 6 years*

Treatment	Tappability percentage
Naturals	13.17[a]
Legumes	25.58[b]
Dead mulch	66.85[c]

Yield data obtained during the early stages of the tapping cycle showed that the trees under mulch were superior to the trees in legumes and naturals (Table 2).

Table 2. *Effect of different soil management practices on early yield of Hevea*

Treatment	Yield (Kg/ha/yr)				
	1989	1990	1991	1992	1993
Naturals	803[a]	878[a]	899[a]	1218[a]	1385[a]
Legumes	850[a]	907[a]	928[a]	1242[a]	1395[a]
Dead Mulch	953[b]	1035[b]	1235[b]	1595[b]	1619[b]

The present value of the benefit achieved from mulching amounts to Rs.42,500/= per hectare of which Rs.28,500/= is due to extra yield (Table 3) and the balance of Rs.14,000/= is the savings on inputs due to early maturity[5].

The Net Present Value (NPV) per hectare and the corresponding "Benefit cost ratio" (B/C) formulated under four different situation are presented in Table 4.

[5] Mulching will bring the trees into bearing one year prior to the conventional method, thereby saving one year's expenditure on inputs. Assuming an average yield of 1000 kg/ha/yr and C.O.P. of Rs. 25/kg this years expenditure will be Rs. 14,000 (assuming the savings on inputs were obtained in the 5th yr of planting with a compound factor of 0.5674).

Table 3. *Increase in yield and income in response to mulching upto 11th year of planting*

Year of planting	Yield (kg/ha/yr)		Yield increase due to mulching (Kg/ha/yr)	Benefit due to extra yield1′	Discount factor for 1′ at 12% interest	Present value of Benefit (Rs/ha/yr)
	Mulching with straw	Legumes only (Conventional method)				
Year 6	325	Nil	325	14625	0.5066	7409
Year 7	760	285	475	21375	0.4523	9668
Year 8	953	675	278	12510	0.4039	5053
Year 9	1035	907	128	5760	0.3606	2077
Year 10	1235	928	307	13815	0.3220	4448
				Net Present Value (NPV) of Benefit		28655

1′ – @ Rs 45 per kg

Table 4. *Net present value of benefit and benefit/Cost ratio under different situations*

Situation	Net Present Value (Rs/ha)	Benefit/Cost Ratio	NPV at macro level (Rs/3000ha/yr)
i. Value of extra yield upto 11th year of planting (excluding cost of straw)	14837	14.7	4.4 million
ii. Value of extra yield upto 11th year of planting and savings on inputs (excluding cost of straw)	26185	25.2	7.8 million
iii. Value of extra yield upto 11th year of planting (including cost of straw)	9430	2.5	2.8 million
iv. Value of extra yield upto 11th year of planting and savings on one years inputs (including cost of straw)	20778	4.2	6.2 million

Data on the influence of ground covers including mulch on soil erosion losses (Fig. 2) indicated that the plots in mulch had the least soil erosion loss as compared to other treatments. Plots in bare land recorded a total soil loss of 60.91 tones/ha over the 3 year period in comparison with a loss of only 3.55 tones/ha in the plots in mulch.

The Technique of mulching with Paddy Straw

Method of application

* Mulching should be done around the base of the rubber plants.

* Paddy straw should be loosely spread over the weed free circle of the rubber plants.

Frequency and time of application

* 1st application of straw should be done immediately after planting, around the base of the rubber plants.

* Exposed soil patches of the newly planted land should also be mulched to prevent soil erosion.

* Mulching should be done two times per year, during the paddy harvesting period (March/April and August/September) when the mulching material (straw) is freely available.

Rate of application

The recommended rates of application of paddy straw (around the base of rubber plants) are given in Table 5.

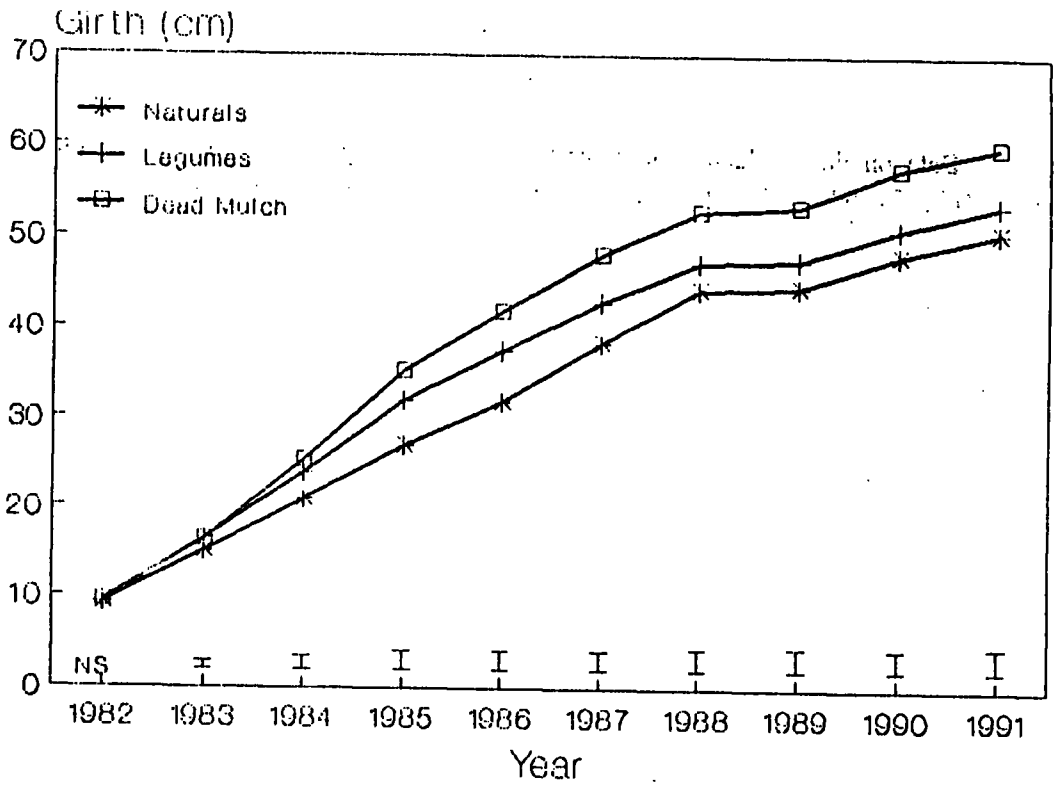

Fig. 1 Effect of different soil management practices on girth of rubber plants

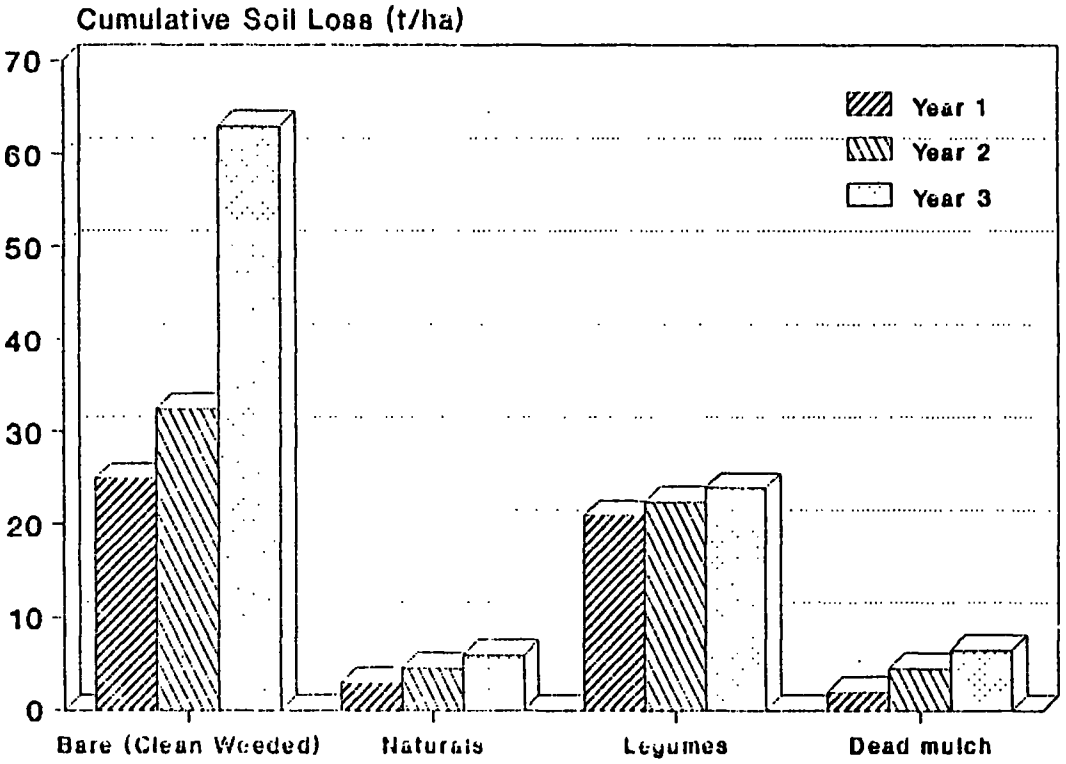

Fig. 2 Effect of ground cover treatment on total soil loss

Table 5. *Rates of application of paddy straw (per tree)*

Year of planting	Amount per application
During the 1st year after planting	2 kg/application
2nd year	3 kg/application
3rd and 4th year	4 kg/application
5th year until tapping	5 kg/application

The minimum paddy extent required according to rubber holding sizes to obtain the recommended straw requirements is given in Table 6.

Table 6. *Extent of minimum paddy holding for supply of annual straw requirement according to rubber holding size*

Size of rubber holding (ha)	Straw requirement (kg/ha/yr)	Equivalent paddy holding size (ha)1/
0.2	1000	0.08
0.4	2000	0.17
0.6	3000	0.25
0.8	4000	0.33
1.0	5000	0.42
1.5	7500	0.63
2.0	10000	0.83
2.5	12500	1.04

1/ 6000 kg/harvest/ha x 2 harvesting seasons /yr

Benefits of Mulching

* Soil losses likely to occur due to erosion from bare lands which are in the region of 60–65 tons/ha/yr could be avoided or atleast minimized to 3–5 tons by mulching.

* Cover crops grown around the base of the rubber plants (weed free circle) may also compete with rubber for moisture and some nutrients. This may result in the retardation of growth of young rubber plants. Growth of legume creepers into the weed free circle can be controlled by mulching.

* Weed growth in general can also be reduced markedly by mulching.

* Girthing would be much higher with mulching when compared to the conventional practice of growing creeping legumes. This would result in the reduction of the immature unproductive period by 12 – 18 months. The estimated savings on inputs as a result of early maturity is around Rs.14,000/= per hectare.

* Mulching improves the chemical, physical and biological characteristics of the soil.

* It is also possible to obtain higher yields in the region of 33% at the early stages of the mature productive period in comparison with the conventional practices. The benefit likely to be achieved due to extra yield during the initial years of tapping (up to 5 years) is about Rs.30,000 per hectare.