

## EFFECT OF DIFFERENT MULCHING MATERIALS ON SOIL PROPERTIES AND GROWTH OF YOUNG TEA

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Mulching is an important cultural practice for soil moisture conservation in tea lands. However, this practice is restricted due to unavailability of recommended materials such as Mana (*Cymbopogon confertiflorous*) and Guatemala (*Tripsacum laxum*) grass in adequate quantities. Hence an investigation was carried out to study the feasibility of using paddy husk, saw dust and refuse tea as alternative mulching materials. Results indicated that these could be used as alternative mulching materials when grass loppings are not available. However, a thick layer of paddy husk will impede water seepage and hence, should be applied as a thin layer.

### INTRODUCTION

New clearings in which young tea is planted remain exposed to the vagaries of weather until such time a canopy is formed to provide an adequate soil cover. As a result, new clearings are subject to erosion, soil moisture evaporation and proliferation of weed growth. In order to minimize these effects, it is necessary to provide a ground cover with a dead or live mulch. Live mulch such as cover crops may compete with tea for moisture particularly during dry periods resulting in growth retardation and even death of young plants during drought (Manipura, 1972). Mulching in tea plantations, is commonly known as thatching. The materials generally used are loppings of Guatemala and Mana grasses. Mulching results in enhanced plant growth, increased soil fertility, conservation of soil and soil moisture (Manipura, Somaratne and Jayasooriya, 1969), suppression of weed growth (Othieno, 1980) and also increased yields (Sandanam and Rajasingham, 1982).

Loppings of grass are generally used in the field soon after planting young tea and at the tail end of the monsoon but, well before the onset of the drought. The quantity of grass loppings required for thatching is about 30-40 t ha<sup>-1</sup> (fresh weight) which can be obtained from a hectare of well tended grass clearing in a single lopping. For this purpose, maintenance of a separate area under a grass species as "thatch bank" is advocated in order to provide the required mulching materials. However, this is not practically possible in all estates due to unavailability of land, especially when embarking on large scale replanting programmes. As a result of such inadequacies the envisaged benefits of thatching young tea cannot be achieved. Therefore, a study was conducted at St. Joachim Estate, Ratnapura (60 m amsl) in a new clearing to examine the feasibility of using locally available waste products as alternative thatching materials and their effects on moisture conservation, minimizing drought effects, enhancement of plant growth and yield.

## MATERIALS AND METHODS

Five types of mulching materials viz. Mana grass, Guatemala grass, saw dust, paddy husk and refuse tea were tested with a control where no material was applied. The treatments were randomized in three blocks of clone TRI 3055. The plot size was 18 m<sup>2</sup> where 25 plants were accommodated. Fresh Mana and Guatemala loppings were applied at the rate of 37.5 t ha<sup>-1</sup> and all the other materials were applied as a layer of about 5 cm thickness. The materials were uniformly spread about 15 cm away from the collar of the plant. Paddy husk and saw dust were treated with urea, at the rate of 2.5 and 3.5 kg per 100 kg respectively, before application in order to reduce their C/N ratio (Wickremasinghe, 1984). The quantity of mulching materials applied on a dry matter basis is given in Table 1.

TABLE 1 - *Thatching materials used and rate of application*

<i>Material</i>	<i>Dry weight (t ha<sup>-1</sup>)</i>
Mana grass	9.4
Guatemala grass	7.5
Saw dust	14.4
Paddy husk	9.0
Refuse tea	21.6

The mulching was repeated every 4 months. The assessments were made, both during dry and wet weather periods as discussed below. The soil temperature and soil moisture content were measured at a depth of 0-15 cm during the dry season (February to March), about 8-9 months after the first application of mulching materials. The soil moisture content was gravimetrically estimated and soil temperature was recorded using an ordinary thermometer. The soil nutrient analysis was done one year after the first mulching. Organic C content was determined according to the Walkley and Black method, N was determined by the Kjeldahl method and K by using a flame photometer. The assessments on drought effects done during the dry period in March were based on visual observations, where a score was given to each bush in a plot in the following manner:

<i>Drought effect</i>	<i>% Visual score</i>
Wilting and defoliation	100
Wilting of all leaves	50
Wilting of only tender shoots	25
No visible adverse effect	0

Scores of individual bushes were added and the mean was taken as the score for the plot.

The growth assessments were made one year after the application of mulching materials. The tipping weights and number of plucking points at the commencement of plucking and the yield of tea at every harvest were also recorded.

## RESULTS AND DISCUSSION

Soil moisture content, in all mulched plots was significantly higher than the control during dry weather (Table 2) . The highest soil moisture content was observed in plots mulched with Mana grass followed by Guatemala grass. Soil temperature at a depth of 15 cm was also low in mulched plots. This temperature regulation by mulching was also observed by Othieno and Ahn (1980). Soil temperature was reduced by 2.9 - 7.5°C due to mulching. Further, soil temperature under the mulch of grass loppings was significantly lower than that under the other materials. The higher soil moisture content recorded in mulched plots could be attributed to reduced evaporation and increased soil permeability with mulch (Russel, 1973). In addition, reduced transpiration of tea plants brought about by low soil temperature under mulch would also have contributed to conserve soil moisture as observed by Steward (1959).

TABLE 2 – *Effect of mulching on soil moisture content and temperature*

<i>Treatments</i>	<i>% Moisture content</i>	<i>Temperature °C</i>
Mana grass	7.65	32.1
Guatemala grass	7.05	32.0
Saw dust	6.86	36.6
Paddy husk	6.52	35.0
Refuse tea	6.53	35.3
Control	4.95	39.5
LSD (P=0.05)	1.15	2.1

### Soil Organic Matter and Nutrients

There was a substantial increase in the soil organic matter content with mulching except with paddy husk (Table 3). However, only refuse tea and Guatemala grass loppings had given a significant increase in organic matter content compared with the control. The low organic matter content in plots mulched with paddy husk may be due to the slow rate of decomposition of this material which has a high C/N ratio (Wickremasinghe, 1984). With the exception of saw dust there was a significant increase in soil N content due to mulching. Grass loppings and refuse tea had increased N content in the top layer of soil by 0.079 - 0.108% which is 35-40% increase over the plots with no mulching (control). The contribution of paddy husk and saw dust to soil N ranged from 15-20% over the control. There was a significant increase in soil K under refuse tea and Guatemala grass lopping mulch compared with the control. However, saw dust and paddy husk did not show a significant contribution to soil K.

**TABLE 3 – Effect of mulching on soil N, K and organic matter content**

<i>Treatments</i>	<i>Nitrogen (%)</i>	<i>Potassium (ppm)</i>	<i>Organic C (%)</i>
Mana grass	0.109	43.3	1.39
Guatemala grass	0.106	59.3	1.89
Saw dust	0.081	37.3	1.49
Paddy husk	0.094	35.3	0.97
Refuse tea	0.106	110.0	1.84
Control	0.079	27.3	1.05
LSD (P=0.05)	0.014	21.2	0.53

### **Effect of Mulching on growth of Young Tea**

The measurements of plant height, collar thickness (girth) and dry weight of shoots at tipping are given in Table 4.

**TABLE 4 – Effect of mulching on growth of young tea**

<i>Treatments</i>	<i>Plant height (cm)</i>	<i>Girth (cm)</i>	<i>Dry wt. of tippings (kg plot<sup>-1</sup>)</i>
Mana grass	102	2.77	0.860
Guatemala grass	99	3.77	0.840
Saw dust	100	2.97	0.784
Paddy husk	96	1.94	0.728
Refuse tea	103	3.68	0.846
Control	88	2.09	0.494
LSD (P=0.05)	NS	1.06	NS

Though the observed differences in plant heights and dry weight of tippings were not significant, there was an overall increase in these attributes in mulched plots compared with the control plots. There was a significant increase in girth with the mulch of grass loppings such as Guatemala and refuse tea while there was no increase of these plant attributes with the mulch of paddy husk.

### **Effect of Mulching in Relation to Drought**

The visual score on drought effects is presented in Table 5.

**TABLE 5 – Effect of mulching on drought response of plants**

<i>Treatments</i>	<i>% Visual score</i>
Mana grass	6.7
Guatemala grass	13.3
Saw dust	21.7
Paddy husk	36.7
Refuse tea	41.7
Control	56.7
LSD (P=0.05)	23.1

Least visual score was observed in plots mulched with Mana grass followed by Guatemala grass and saw dust. Even though the plots mulched with paddy husk and refuse tea had a lower visual score, the reduction was not significantly different from control. Assessments on drought effects (visual scores) confirm the beneficial effects of mulching i.e. soil moisture conservation, reduction in soil temperature and addition of plant nutrients which enhanced vigour of young tea plants as explained previously.

### Effect of Mulching on Yield of Tea

The tea was brought into plucking two years after planting. The number of plucking points per bush at the commencement of plucking and the yield recorded during the first year of plucking are presented in Table 6.

TABLE 6 – *Effect of mulching on yield of tea*

<i>Treatments</i>	<i>No. of plucking points per bush</i>	<i>Yield (made tea kg ha<sup>-1</sup> yr<sup>-1</sup>)</i>
Mana grass	25.0	3137
Guatemala grass	24.3	3237
Saw dust	22.9	3037
Paddy husk	20.1	2988
Refuse tea	25.8	3110
Control	16.7	2845
LSD (P=0.05)	5.3	NS

Mulching resulted in 37-54% more plucking points at the commencement of plucking. However, this was only about 20% with paddy husk. The higher number of plucking points resulted in higher yield during the first year. However, the increase in yield with mulching was not significantly different from the control.

### CONCLUSION

The beneficial effects of mulching on growth of tea and soil moisture retention were reconfirmed from this investigation. In addition, its contribution in enhancing the soil fertility was further highlighted.

Although mulching with grass loppings continued to be superior to the other mulching materials, the latter may be used in new clearings to minimize the adverse effects of drought when grass loppings are not available and are useful alternative mulching materials.

However, in materials such as paddy husk when applied as a thick layer, water seepage is impeded until the materials are well decomposed and hence should be used with utmost care. It must be noted that it has a wide C/N ratio as well. Moreover, such waste materials are light with smaller particles and have a tendency to slide down when applied on steep lands. Therefore, they may be restricted only to gently sloping and flat lands.

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