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# FARMER PREFERENCE FOR BIOLOGICAL SOIL EROSION CONTROL MEASURES: A CASE STUDY IN THE CENTRAL PROVINCE

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## ABSTRACT

**Biological soil erosion control measures have become increasingly popular among farmers in the recent past. Ã field survey was conducted to understand farmer preference for biological soil erosion control measures. This survey was carried out in 1999 in the intermediate zone (IZ) in the Hanguranketha area and in wet zone (WZ) in the Kothmale area of the Central Province. A sample of 65 farmers was selected at random and the sample included vegetable growers in the IZ, vegetable, tea and mulberry growers in the WZ. Information regarding farmer preference for different biological erosion control measures was obtained using a questionnaire. The results showed that more than 80% farmers who have adopted biological erosion control measures, preferred continuation of these biological measures in their lands. Gliricidia hedgerows and Vetiver strips were more popular among the biological measures. Vegetable growers in the IZ preferred Gliricidia and in the WZ Vetiver. Tea growers have adopted both Gliricidia and Vetiver. Mulbery growers preferred only Gliricidia. More than 80 % farmers put biomass back to the land. Vegetable growers in the IZ in addition use Gliricidia biomass for other purposes such as manure (62%), animal feeding (33 %), firewood (71 %) and for trellises (81 %). This study indicates that crops cultivated and agro ecological variations are two factors determining farmer preference for biological soil erosion control measures. These factors should be taken into consideration while promoting biological soil erosion control measures among farmers.**

**KEY WORDS**: Farmer preference, Biological erosion control

## INTRODUCTION

In Sri Lanka, soil erosion and fertility decline are the two main land degradation processes and nearly 33% of the land extent in the island is subjected to soil erosion (Nayakakorale, 1998). Further, Stocking (1992) reported a soil loss of 40, 70, 38, and 18 t/ha/year from old seedling tea, tobacco, capsicum and carrot, respectively. Krishnarajah (1984) showed soil losses due to erosion under different vegetative cover management. Above information show the need of drawing a priority attention for soil erosion control in this country. With the establishment of plantation agriculture in Sri Lanka, mechanical measures have also been introduced for soil erosion control in plantation crops particularly in tea. Apart from the plantation sector, such mechanical measures have also been popular mainly among resource rich individual farmers, as field establishment of mechanical structures needs significant investment. On the other hand, resource poor farmers continue their cultivation without taking adequate mechanical soil erosion control measures in most cases. Taking this situation into consideration, biological measures for soil erosion control such as establishment of legume tree hedgerows and grass strips have been introduced few decades back. These

biological measures have also been used among farmers to a certain extent and it needs further popularization. The aim of this field investigation was to understand farmer preference for biological soil erosion control measures. This information is useful for planning of future programs in the popularization of biological soil erosion control measures among farmers.

## MATERIALS AND METHODS

The study was conducted in 1999 in the Central Province. The villages selected for the field survey included four villages (Kivul-linda, Idame-landa, Uda-watta - and Gala Uda) from the Hanguranketa area in the Intermediate Zone (IZ) and another four villages (Doragala, Dawatagas, Kitul Bedda and Weliganga) from the Kothmale area in the Wet Zone (WZ). A sample of 65 farmers was selected at random. The sample included vegetable growers on rainfed uplands in the IZ and vegetable, tea and mulberry growers in the WZ. Vegetable growers on rainfed uplands cultivate vegetables only during the Maha season and in the Yala season, the land is kept fallow. Information regarding farmers' preference for different biological soil erosion control measures was obtained using a questionnaire. The questionnaire included following information (i) general information of the farm family (ii) availability of family labour, farm machinery and domestic animals (iii) capacity of the farmer to invest on farming (iv) characteristics (soil type, slope % type of vegetation catenal position etc.) of the land on which biological soil erosion control measures have been adopted (v) other soil erosion control measures (contour bunds, drains terraces etc.) that have been adopted in the land in combination with biological soil conservation measures (vi) particulars regarding the management of biological erosion control structures (legume tree hedgerows and grass strips) (vii) information regarding the management of companion crops (viii) farmer preference for biological measures in comparison with mechanical measures (ix) uses of tree and grass prunings (x) changes in soil and crop that have been observed by the farmer with the continuation of maintenance of biological structures in the land.

The changes investigated in this field survey included (i) reduction of soil erosion (ii) reduction of runoff (iii) increase of infiltration (iv) improvement of soil fertility (v) improvement of soil tilth (vi) changes in pest and disease damages on crops (vii) wilting of the crop (viii) shade effects on crops (ix) reduction of space available for the crop (x) changes in crop yields (xi) reduction in weed growth (xii) changes in bird damages on crop and (xiii) comfortability for workers. All the information was analyzed in achieving the study objectives.

## RESULTS AND DISCUSSION

### Establishment of biological soil erosion control measures on farmer fields and their expansion within the farmer field.

It was observed in this study that the entire farmland has not been adopted with biological measures. The average extent of the farmland was 0.59, 0.47 and 0.30 ha on which Vetiver strips in the WZ, Gliricidia hedgerows in the WZ and Gliricidia hedgerows in the IZ have been adopted, respectively (table 1). Vetiver strips have been established only in 40% of the total land extent. In contrast 92% and 72% of the farmland have been established with Gliricidia hedgerows in the WZ and IZ, respectively.

**Table 1. Extent adopted with biological erosion control structures.**

| *Item* | *Biological erosion control measures* | | |
|---|---|---|---|
| | *Wet Zone* | | *Intermediate Zone* |
| | *Vetiver strips* | *Gliricidia hedgerows* | *Gliricidia hedgerows* |
| Mean extent of the plot on which biological measures are established (ha) | 0.24 | 0.44 | 0.22 |
| Mean extent of the plot adopted with biological measures as a % of the total land extent | 40.1 | 92.4 | 72.0 |
| Mean percentage of farmers who wish to continue maintenance of biological measures | 89.7 | 81.8 | 95.2 |

The reason for establishment of a greater portion of the land with Gliricidia hedgerows in comparison with that of Vetiver strips was the better availability of Gliricidia stems than the Vetiver cuttings in the study area. Further, more than 80% farmers wish to continue biological measures established by them. It shows a satisfactory acceptance of this technology by farmers.

### Adoption of biological measures in combination with mechanical measures in soil erosion control

In soil erosion control, some farmers depend on one method and some use more than one method. The later is the basis for the development of an integrated approach in soil erosion control. Table 2 shows the percentage of farmers who adopt other soil erosion control measures in combination with major biological measures. Terraces, stonewalls, contour drains and earth

bunds were the other mechanical measures adopted in combination with biological measures. Gliricidia hedgerows, Vetiver strips and grass strips were the dominant biological structures adopted by farmers.

**Table 2. Other soil erosion control measures adopted in combination with major biological measures**

| *Adoption of other soil erosion control measure (as a % of farmers)* | *Major Biological soil erosion control measure* | | |
|---|---|---|---|
| | *Wet Zone* | | *Intermediate Zone* |
| | *Vetiver strips* | *Gliricidia hedgerows* | *Gliricidia hedgerows* |
| Terraces | 58.6 | 18.2 | 9.5 |
| Stone walls | 24.1 | 27.3 | 9.5 |
| Contour drains | 17.2 | 9.1 | 14.3 |
| Earth bunds | 3.4 | 0.0 | 4.8 |
| Gliricidia hedgerows | 0.0 | - | - |
| Vetiver strips | - | 9.1 | 4.8 |
| Grass strips | 27.6 | 0.0 | 9.5 |

Although varieties of other measures have been adopted in combination with major biological structures, the adoption has exceeded more than 20% of farmers only in terraces with Vetiver strips, stone walls with Vetiver strips and Gliricidia hedgerows and grass strips with Vetiver strips only in the wet zone. Vegetable growers on rainfed uplands in the intermediate zone have almost totally depended on Gliricidia hedgerows.

## Uses of Gliricidia and Vetiver biomass

Biological soil erosion control structures periodically generate significant quantities of biomass. This biomass can be put back to the land or be used for other purposes such as feeding domestic animals, green manure for companion crops, trellises for climbing vegetables such as bitter gourd, ridged gourd and supports for succulent plant vegetables such as tomato. In the study area farmers use tree or shrub biomass for variety of purposes.

Results of this study showed that more than 80.0% of farmers put biomass of Gliricidia or Vetiver back to the land (table 3). In the wet zone, Vetiver biomass is being used for manuaring crops and feeding animals by 3.4% and 13.8% farmers, respectively. In contrast, Gliricidia biomass is being used only for feeding domestic animals by 9.1% farmers. It shows that use of tree or shrub biomass for other purposes is not a major practice in the wet zone. The reason could be that those farmers are mainly tea and mulberry growers. They use chemical fertilizer for fertilizing their crops. Further, Gliricidia trees are pruned with closer intervals in the wet zone. Therefore,

Gliricidia prunings contains much more green materials and therefore it does not have any timber value.

**Table 3. Uses of Gliricidia and Vetiver biomass**

| *Uses (as a % of farmers)* | *Major Biological soil erosion control measure* | | |
|---|---|---|---|
| | *Wet Zone* | | *Intermediate Zone* |
| | *Vetiver strips* | *Gliricidia hedgerows* | *Gliricidia hedgerows* |
| Application of leaves/stems back to the land | 85.6 | 77.6 | 93.4 |
| Leaves as manure for crops | 3.4 | 0.0 | 62.0 |
| Leaves for feeding animals | 13.8 | 9.1 | 33.0 |
| Stems for maintaining Gliricidia hedgerows | 0.0 | 0.0 | 38.0 |
| Stems as fire wood | 0.0 | 0.0 | 71.4 |
| Stems as trellises / supports | 0.0 | 0.0 | 81.0 |

In the intermediate zone, most of farmers those who adopt biological measures were vegetable growers on rainfed uplands. Only the *maha* season is cultivated with rainfed vegetables. In this farming situation, farmers use Gliricidia biomass not only for putting back to the land but also for variety of some other uses. Among other uses, 62.0% farmers use tree leaves for manuring their crops. Thirty three percent farmers feed their domestic animals such as cattle and goat with Gliricidia loppings. Most of these farmers cultivate climbing vegetables such as bitter gourd, luffa and snake gourd. Therefore, they need trellises for those vegetables. This study shows that 81.0% farmers in this area use large stems of Gliricidia pruning for trellising purpose. This is a significant reduction of their crop cultivation cost as such a single tree stem cost about Rs. 1.50, if they buy from outside. In addition, 38.0% farmers use Gliricidia tree stems for planting the vacancies appeared in Gliricidia hedgerows. Similarly, Gliricidia stem is a good source of firewood and about 71% farmers in this area use Gliricidia stems as firewood. In this case firstly they use stems for providing trellises for climbing vegetables or supports for crops like tomato. Thereafter, with the harvest of their crops, Gliricidia stems used as trellises or supports are taken to use as fire wood.

## Changes in land characteristics due to establishment of biological structures

In addition to control of soil erosion, biological structures may change land characteristics such as infiltration, runoff, soil fertility, soil tilth, weed growth *etc.* In this study, farmer's visual observations on such 13 land characteristics were investigated. All farmers observed a reduction in soil erosion with the establishment of Gliricidia hedgerows both in wet and

intermediate zones (table 4). In the case of Vetiver strips, about 93 farmers observed a control of soil erosion. In other land characteristics studied, farmers' observations were different for different biological structures. Greater fraction of farmers observed changes in infiltration, surface runoff and soil fertility. In addition to control of soil erosion, improvement of other land characteristics is an additional benefit of biological structures over mechanical structures. Farmer preference also depends on presence of such additional benefits of biological structures.

**Table 4. Changes in land characteristics due to establishment of biological soil erosion control measures**

| *Change in land characteristics (as a % of farmers)* | *Major biological soil erosion control measure* | | |
|---|---|---|---|
| | *Wet Zone* | | *Intermediate Zone* |
| | *Vetiver strips* | *Gliricidia hedgerows* | *Gliricidia hedgerows* |
| 1. Reduction of soil erosion | 93.1 | 100 | 100.0 |
| 2. Increase of infiltration | 34.5 | 54.5 | 95.2 |
| 3. Reduction of surface runoff | 58.6 | 90.9 | 95.2 |
| 4. Improvement of soil fertility | 34.5 | 36.4 | 61.9 |
| 5. Improvement of soil tilth | 13.8 | 36.4 | 47.6 |
| 6. Changes in pest/diseases on crops | 3.4 | 0.0 | 4.8 |
| 7. Increase of shade on crops | 3.4 | 27.3 | 19.0 |
| 8. Reduction of space for crops | 0.0 | 0.0 | 28.6 |
| 9. Changes in crop yields | 17.2 | 18.2 | 19.0 |
| 10. Reduction of weed growth | 17.2 | 36.4 | 42.9 |
| 11. Changes in bird damages on crops | 0.0 | 0.0 | 9.5 |
| 12. Increase of comfortability for workers | 17.2 | 18.2 | 47.6 |
| 13. Increase of wilting of the crop | 0.0 | 0.0 | 14.3 |

## Farmer preferences on biological soil erosion control measures

Farmer preference for one method is generally determined in comparison with presently available other measures of soil erosion control. In this study mechanical measures were taken for comparison. The farmer prefer mechanical measures but due to some difficulties in the adoption of mechanical measures they have selected biological measures. If the effectiveness of biological measures is equal to mechanical measures in soil erosion control, the situation was considered as good. If the farmer prefers biological measures in comparison with mechanical measures as biological measures give some additional benefits, the situation was considered as very

good. The additional benefits included provision of green manure, animal feed, firewood and availability of hedgerow tree stems for making trellises.

The results showed that greater fraction of farmers (81.0%) in the IZ said Gliricidia hedgerows are very good as soil erosion control (table 5). It was about 64.0% and 76.0% in Gliricidia hedgerows and Vetiver stripes, respectively in the WZ. It shows that farmer preference was greater for Gliricidia hedgerows in the IZ and Vetiver stripes in the WZ. In the WZ, Gliricidia hedgerows have been mainly adopted in mulberry cultivation because farmers have been asked to establish Gliricidia hedgerows in combination with mulberry by the promoters of the mulberry crop. The reason for promotion of Gliricidia is that shrubs such as Vetiver and grasses cannot be compete with mulberry in the canopy establishment. It was the reason for obtaining a farmer preference of 63.6% as very good. However in the vegetable cultivation, most of farmers do not prefer for Gliricidia hedgerows in the WZ.

**Table 5. Farmer preference on biological soil erosion control measures.**

| *Farmer preference (as a % of farmers)* | *Major biological soil erosion control measure* | | |
|---|---|---|---|
| | *Wet Zone* | | *Internidiate Zone* |
| | *Vetiver stripes* | *Gliricidia hedgerows* | *Gliricidia hedgerows* |
| Very good | 75.9 | 63.6 | 81.1 |
| Good | 17.2 | 27.3 | 14.3 |
| Satisfactory | 6.9 | 9.1 | 4.6 |

## CONCLUSION

More than 80.0% of farmers preferred to continue maintenance of biological measures as soil erosion control measures. Among the biological measures, Gliricidia hedgerows and Vetiver stripes were more popular.

The preference for Gliricidia hedgerows and Vetiver stripes mainly depends on type of crop grown by the farmer and agro-ecological variations. Vegetable growers prefer Gliricidia hedgerows in the Intermediate Zone and Vetiver stripes in the Wet Zone. Tea growers in the Wet Zone have adopted both Gliricidia hedgerows and Vetiver stripes. Mulberry growers in the Wet Zone totally depend on Gliricidia hedgerows.

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