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AN ECONOMIC EVALUATION OF THE USE OF RAINGUARDS

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ABSTRACTS

Use of rainguards can minimize the loss of tapping days and hence the loss in rubber crop. A simple model was developed to study different components determining the profitability of rainguards. Model was then applied to the Kalutara district where relevant data are available. This study revealed that at the present condition of the rubber industry, apron type is financially worthwhile, but not the gutter.

How each component affects profitability of using rainguard is discussed. Price of rubber, yield potential of a plant and tapping wage rate were identified as most important factors which determine the worthiness of the use of rainguards. Scalent price is also a major factor in deciding profitability. If the price of scalent is less than Rs.20/= per kg, the profitability from both the apron and the gutter types is same.

Key words: Rainguard, Economic, Financial, Modelling

INTRODUCTION

Rubber growing areas in Sri Lanka are mainly confined to South Western region. These areas are subjected to heavy wet monsoon periods which stretch from May to July and September to November. Though yield potential of trees is high during these periods, wet panels, due to rain cause loss in yield in three ways, *ie* 1). no tapping is possible during the day, 2). late tapping days; it is evident that practice of late tapping instead of normal early tapping leads to 20-25% yield drop (de Silva, 1960). 3). a sudden unexpected rain before latex collection would result partial or full washout of latex. Further, loss of tapping days are recovered by double tapping and this may contribute to tapping panel dryness (TPD), a physiological disorder. Also, as double tapping is practiced later in the day, a yield of only ca. 75-80% of the normal tapping can be achieved.

The number of days a tree could be tapped depend on the climatic conditions of that region and also varies from year to year. Data collected from the Dartonfield estate (1988 – 1992) in the Kalutara region, reveals that an average of 200 normal tapping, 35 late tapping and 8 washout days are possible in a year (unpublished data 1993). Therefore, an average 35% of the potential yield is lost due to interference of rain.

Tappers most often are casual workers, thus they are being paid only on working days. Rain interference makes their earnings indefinite and therefore less people undertake tapping. This will lead to a problem of shortage of tappers in future.

Tapping panel remains wet for long periods even after the rain ceases, and this is mainly caused by the water seeping down the trunk. Use of rainguards either Apron or gutter type, can prevent this problem. As a result, there will be more tapping days and the crop harvested will increase.

This study was conducted to identify different components relevant to establishment of rainguards and to develop a simple mathematical model to count time and location specific factors relevant to rainguard application. Also, this model is used to conduct a financial analysis on rainguards.

Rainguard model

Tapping system of 1/2 S d/2 is widely recommended except for the first year or first 3 years of tapping in some clones and during the intensification period in all clones. In this system, tapping is undertaken every other day, thus total tappings for a particular period (DT) will be half of total number of possible tapping days which comprises of normal tapping (DN), late tapping (DL), washout (DW) and double tapping (DD) days.

$$DT = (DN+DL+DW+DD)/2 \quad \text{———(1)}$$

Late tapping causes reduction in yield which could be attributed to loss of turgor pressure in latex vessels late in the day. Also, reduction in yield has been identified as ca.25% (de Silva 1960). If tree yield on a normal tapping day is assumed as YT, then tree yield on a late tapping could be,

$$YT \times 0.75 \quad \text{———(2)}$$

Also, when double tapping is undertaken, trees are tapped later in the day, and gives similar reduction in yield, therefore,

tree yield on a double tapping = YT x 0.75 ———(3)

Few washouts are experienced due to sudden rain between tapping and collection. Though the yield loss varies dramatically, average loss of 50% could be expected (Satchuthananthavale, 1973).

Thus, average yield on a washout day = YT x 0.5 ———(4)

Applying 2,3 and 4 relationships to the equation 1, annual tree yield (YTA) is,

YTA = (DN + 0.75DL + 0.5DW + 0.75DD) YT/2 ———(5)

If plantations are rainguarded though tapping cannot be practiced under heavy rains, number of normal tapping days are increased. Also there is no need for recovery tapping. There will be no washouts but few late tappings could be possible, because of heavy rains during previous night and morning showers. Thus, the total annual tappings of a rainguarded tree (RDT) will be,

RDT= (DN+DL)/2 (As in equation (1)) ——— (6)

And therefore, yield per tree per annum (RYTA) could be,

RYTA=(DN+0.75DL)YT/2 (As in equation (5)) ———(7)

Accordingly, yield advantage (YAR) and the extra income (IR) per tree by having rainguards are,

YAR = RYTA–YTA ———(8)
IR = YAR x PR ———(9)
where, PR is the price of rubber.

Rainguard affects tapping days (*ie* no double tapping and washouts, less late tappings and increases normal tappings) as well as cost of production. Therefore, in order to estimate the profitability, cost involved in the process other than tapping should also be considered.

The tapping cost per tree depends on tapper's wage and tapping task. It is assumed that payments on over kilos, are also added to the tapper's wage. However, payment for double tapping is based on tapper's intake. Cost of manufacture depends on total amount of latex production.

The annual cost of tapping and manufacturing of latex per tree with no rainguards (GX) will be,

$$GX = ((DN+DL+DW)/2)x\ (TW/TT) + (DD/2x0.75YTx\ TK) + (YTA \times CM) \quad \text{——(10)}$$

where, TW – Tapper wage per day
TT – Tapping task (trees)
TK – Payment to the latex collected in double tapping (Rs/Kg)
CM – Cost of manufacture per unit weight of latex (Rs/Kg)

In a rainguarded tree the material and labour cost involved in fixing a rainguard, should also be considered for the analysis.

Therefore, the expenditure per tree with rainguard (GXR) will be,

$$GXR = ((DN + DL)/2 \times TW/TT) + (RYTA \times CM) + FCR \quad \text{——(11)}$$

FCR is the cost of a rainguard which depends on the type. Also, it could be described as a function of polythene, sealent and labour cost.

$$FCR = PP/NP + PS/NS + CL/NL \quad \text{——(12)}$$

where, PP = Price of polythene Rs./kg.
NP = Number of rainguards possible from a kilogram of polythene.
PS = Price of sealent Rs./kg.
NS = Number of rainguards fixed with a kilogram of sealent.
CL = Labour wage Rs./day
NL = Number of rainguards fixed by a labour per day.

NP, NS and NL could be considered generally as constants for particular rainguard type and their respective values are 90, 5 and 70 for gutter type and 40, 10 and 40 for apron type.

Therefore, for the gutter type, the fixing cost (FCRG) is,

$$FCRG = PPG/90 + PS/5 + CL/70 \quad \text{——(13)}$$

PPG – price of polythene – gauge 700

Further, there is an additional cost for twine in apron type. However, as it is a minute component of the total cost, a fixed cost of 25 cents per rainguard is assigned for it.

Accordingly, fixing cost for apron type (FCRS) is,

$$FCRS = PPS/40 + PS/10 + CL/40 + 0.25 \quad \text{———(14)}$$

PPS – price of polythene – gauge 300

Then Additional expenditure (ADX), Net profit (NPR) and Return for the investment (RFI) in rainguard application can be estimated as,

$$ADX = GXR - GX \quad \text{———(15)}$$

$$NPR = IR - ADX \quad \text{———(16)}$$

$$RFI = NPR/ADX \times 100 \quad \text{———(17)}$$

Application of the model for financial analysis

Types of tappings *ie* normal, late, washouts and double, with or without rainguard vary with the location. Anyhow, for a particular location nine major variables of the model can be identified. They are,

Price of sealent
Price of polythene (gauge 700/300)
Price of rubber
Labour wage
Tapper's wage
Cost of manufacture
Rate of payment to the latex in double tapping
Dry rubber yield per tree per tapping
Tapping task

The financial analysis on these variables was confined to the Kalutara district where field data on tapping days are available.

RESULTS AND DISCUSSION

The discussion is primarily based on how the changes in a sensible range of each variable of the rainguard model, affects worthiness of rainguards. In this case, variables were considered one at a time, while others were fixed at average values.

Normal tapping days/yr – 186
Late tapping days/yr – 70
Double tapping days/yr – 50
Washout days – 10
Price of rubber (Rs./Kg) – 35
Price of sealent (Rs./kg) – 35
Price of polythene (Rs./kg) – 72
Cost of manufacture (Rs./Kg) – 5.5
Labour wage (Rs./day) – 80
Tapper's wage (Rs./day) – 80
Tapping task (trees) – 250
Payment for double tapping (Rs./kg) – 6.50
With rainguards, expected normal tapping days/yr – 278
expected late tapping days/yr – 72

Gutter type rainguard

The study revealed that use of gutter type rainguard is not worthwhile under the current situation of the rubber industry. Nevertheless, it could be profitable if at least one of following conditions is met, given that other variable values remain fixed as average values.

rubber price is not less than Rs 37/kg (fig.1)
tapping wage is less than Rs.72/day (fig.2)
sealent price is less than Rs.31/kg (fig.3)
cost of manufacture does not exceed Rs.3.50/kg (fig.4)
average rubber yield is higher than 32gr/tree/tapping (fig.5)
number of trees per tapping task is higher than 275 (fig.6)

As rigid wage rate is the usual practice, tapping wages cannot be reduced to less than Rs.72/day under the estate [1] conditions. Also, cost of manufacture in most of the Estates tends to be higher than Rs.3/kg. Though the current price of commercial sealent is Rs.35/kg, it seems possible to be manufactured at a lower cost. According to Tillekeratne, RRISL (personal communication), cost of manufacturing a kilogram of sealent is Rs.17.50 excluding overhead charges. Also, the sealent is being prepared in Elston estate at a cost of Rs.12.50 per kg. Under these circumstances, it is possible to use gutter type profitably. Price of rubber fluctuates and average price is ca. Rs.30/kg. However with better marketing strategies, it could be possible to reach a higher price than Rs.37/kg making the gutter type profitable.

Though the gutter type is not economical to use for the average tapping task of 250 trees, it won't be the case for tapping task of 300 or more. With the recent privatization of the plantations, some estates have increased the tapping task up to 350 trees.

Present average tree yield level is well below the critical value for gutter type. However, high yielding clones have a potential of giving more than the critical level, thus under good management conditions, it may be worthwhile of using gutter type. This can be achieved in estate level, but not in subsistence level of farming. However, considering the present problem of pest attack, gutter type rainguard may be more suitable than apron type. This study further shows that if the sealent price is around Rs.17/kg, there will be no difference in rate of return (ca. 20%) from the gutter type rain guards compared to the apron type given the fixed average levels of other factors. (fig. 3 and 7)

Apron type rainguard

It is revealed that apron type rainguard is financially viable at current situation of rubber industry. This type is able to give around 7% net return for the investment, under the fixed values mentioned earlier.

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[1]Estate: estate would be considered as production units held by individuals or commercial companies whose main economic objective is to maximize their return on investment. In addition to their own capital, estate companies are able of using land, hired labour and borrowed capital, in volume at a given price plus procurement cost.

Sealent price

At current price of the sealent (*ie* Rs.35/kg), use of Apron type is profitable (see fig.7). Further, a Rs.8/kg increase is tolerable without any loss. However, at the current price of sealent, profitability is not attractive as net return for the investment is less than the general interest rate. Nevertheless, as discussed under the gutter type, there is a possibility of reducing the cost of sealent.

Polythene price

The critical point of polythene price where apron type becomes uneconomical, is 100 Rs/kg (Fig.8). Thus, at current price of polythene, *ie* 65 Rs/kg, this type is economical.

Price of rubber

If price of rubber falls below Rs.33/kg, the investment on rainguards is not financially viable under the given conditions. Price of rubber above Rs.39/kg will lead to more than 18% of net return for the investment (Figure 9). Therefore, the analysis indicates that the price of rubber will play a major role in deciding the worthiness of the investment on rainguards.

Wage Rates

Here the wage rate means labour cost to fix the rainguards. According to the figure 10, at the present wage rate, ca. 6 percent return to the investment can be expected. Most of the smallholders may not be affected by high labour cost as they could use family labour. However, the opportunity cost of labour should be considered as a critical factor, to decide the overall economic benefit.

Cost of Manufacture

As evident from figure 11, if the cost of manufacture is about Rs.8/kg, it indicates the investment for the apron type rainguard is not worthwhile. However, at a cost of manufacture of Rs.3/kg and under the given average fixed values of other factors, around a 17% net return to the investment can be achieved.

Rubber Yield

Dry rubber yield of less than 30g/tree/day is not a favorable situation under the given conditions. However, around 33g/tree/day is very attractive as it will lead to more than 17 percent net return to the investment (fig 12) on apron type rainguards under the given average conditions. Accordingly, implementing rainguards to new high yielding clones such as RRIC 100, 121 etc., will be more beneficial. However, present average yield figures in the smallholder sector is around 20g/tree/day. This situation is mainly due to lack of proper management. Almost 95% of the smallholders are not fertilizing their mature holdings (unpublished survey data 1993). This survey further reveals that poor price level and the loss of tapping days, leads to poor management practices.

Tapping wage and task

Under the conditions mentioned before (p. 5) and if tappers wages are more than Rs.88/day the investment on the rainguards will not be financially viable (fig 13). As the wage paid to tappers increases, the intake per tapper should also be increased to keep the tapping cost constant. Increase in the tapping task should be considered. However, the mechanization against the manual approach for tapping may be more efficient. Net profit increases with the increase of tapping task since per unit cost of tapping wage is decreasing. Tapping task of 300 trees/tapper will lead to around 18% net return for the investment on rainguards (fig 14).

General discussion

According to this analysis, price of the rubber, yield potential of a tree and the tapping wage rates are the most important factors that will affect the financial worthiness of rainguards. At the estate level inclusive of all allowances the average wage rate is around 80–90 Rs./day. At smallholder level this vary from Rs.30–60/day (unpublished survey data, 1993). However, the lack of skilled tappers at smallholder level will lead to an increase in the wage rates in near future. As the rigid wage rate is the usual practice and the price of rubber depends on international market forces, the intake per tapper in this regard is a critical factor to be considered. Proper management practices are essential to increase land productivity. Increase in the tapping task at estate level is one remedy to enhance the labour productivity. However manual approach will be less efficient, hence more considerations must be given to mechanization of tapping. No suitable mechanical system for Sri Lanka has so far been developed.

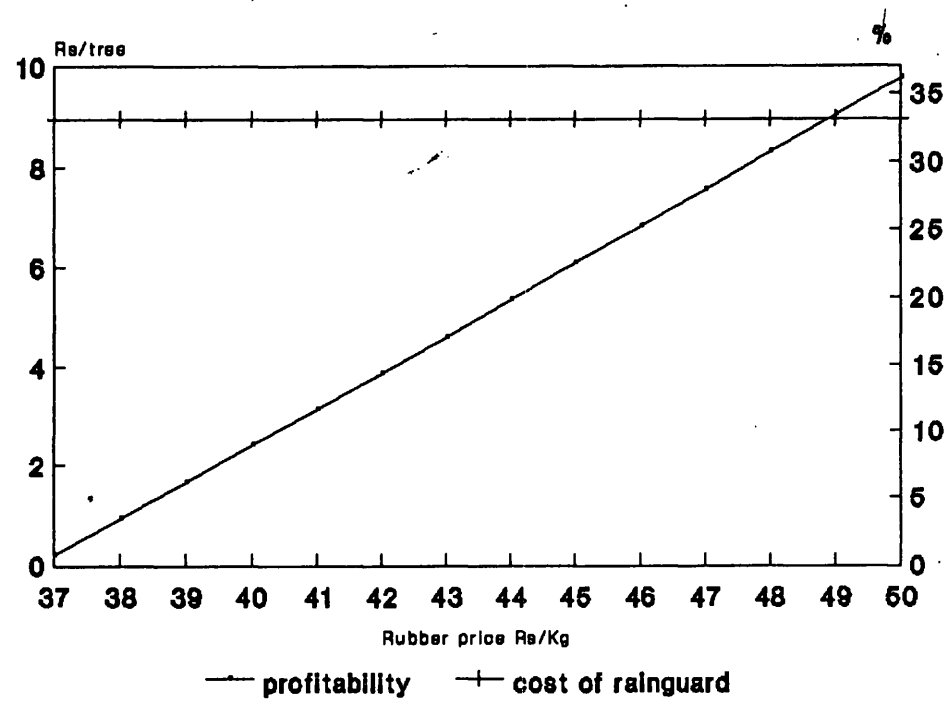

Fig. 1 Effect of rubber price on worthiness of gutter type rainguards

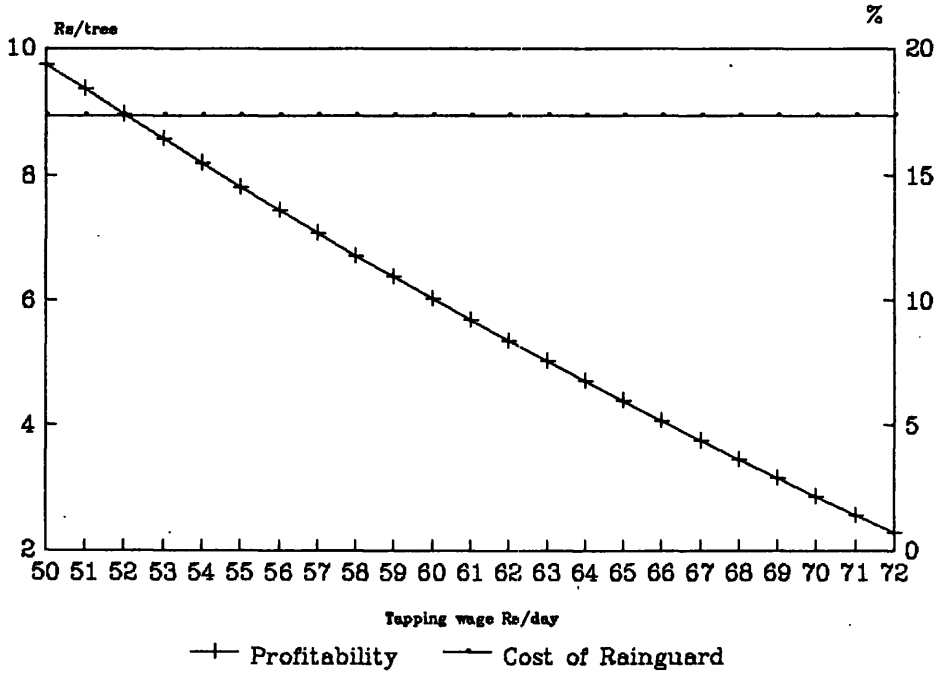

Fig. 2 Effect of tapping wage rate on worthiness of gutter type rainguards

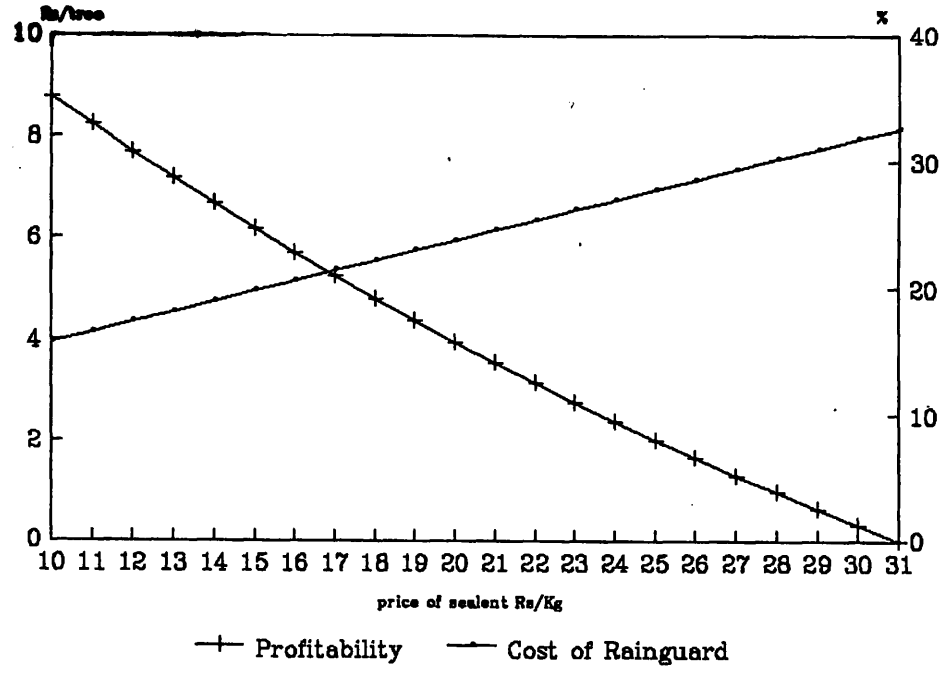

Fig. 3 Effect of sealent price on worthiness of gutter type rainguards

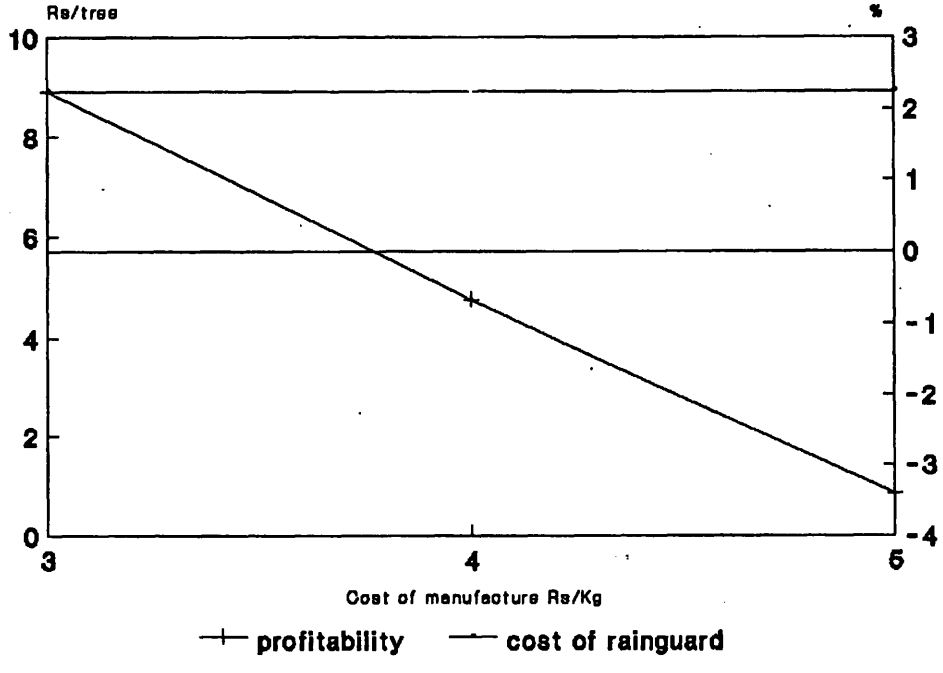

Fig. 4 Effect of cost of manufacture on worthiness of gutter type rainguards

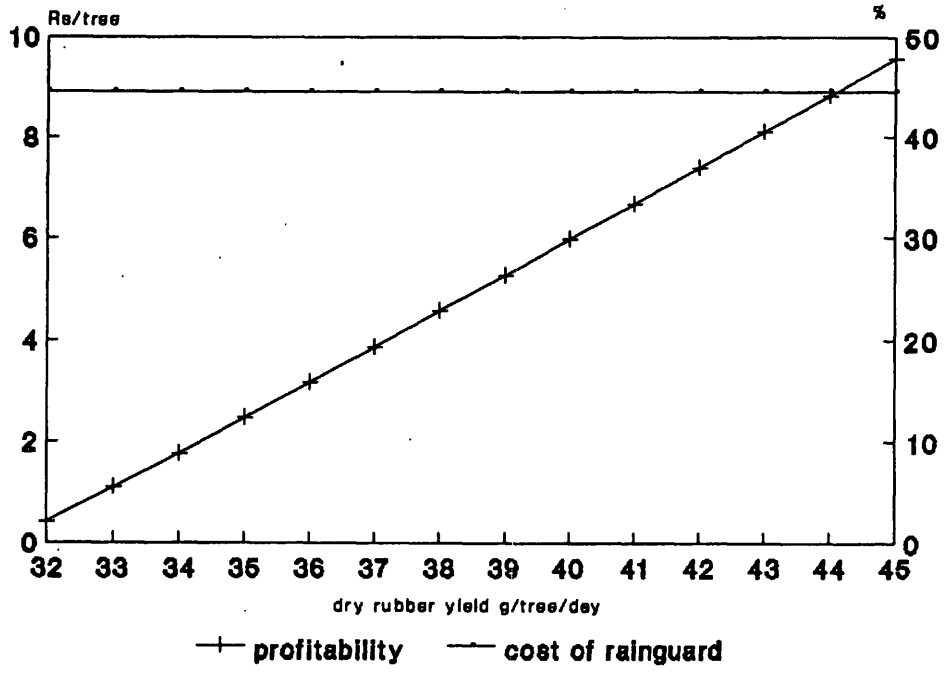

Fig. 5 Effect of dry rubber yield on worthiness of gutter type rainguards

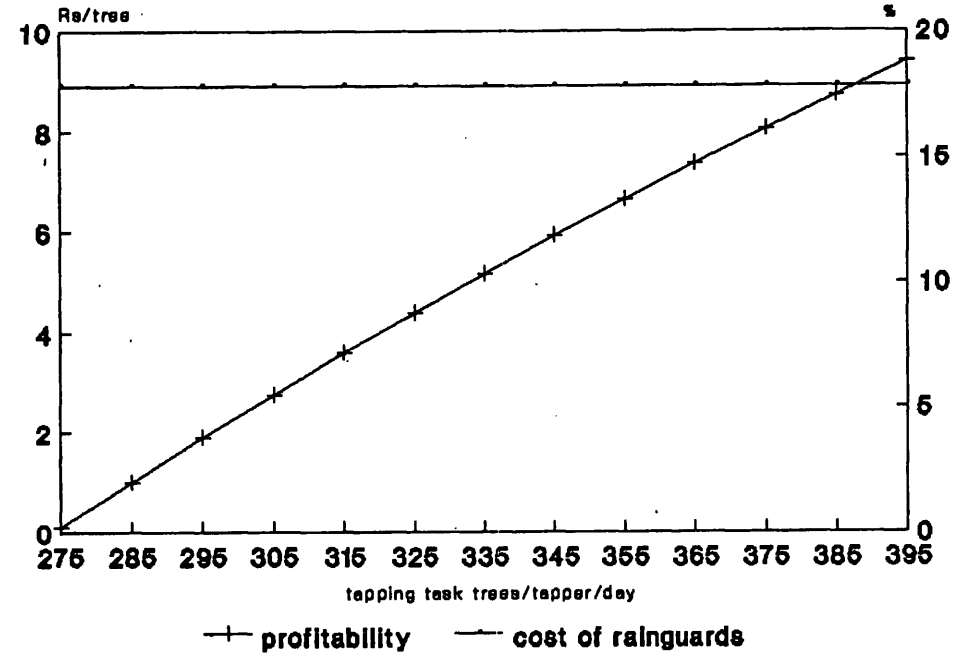

Fig. 6 Effect of tapping task on worthiness of gutter type rainguards

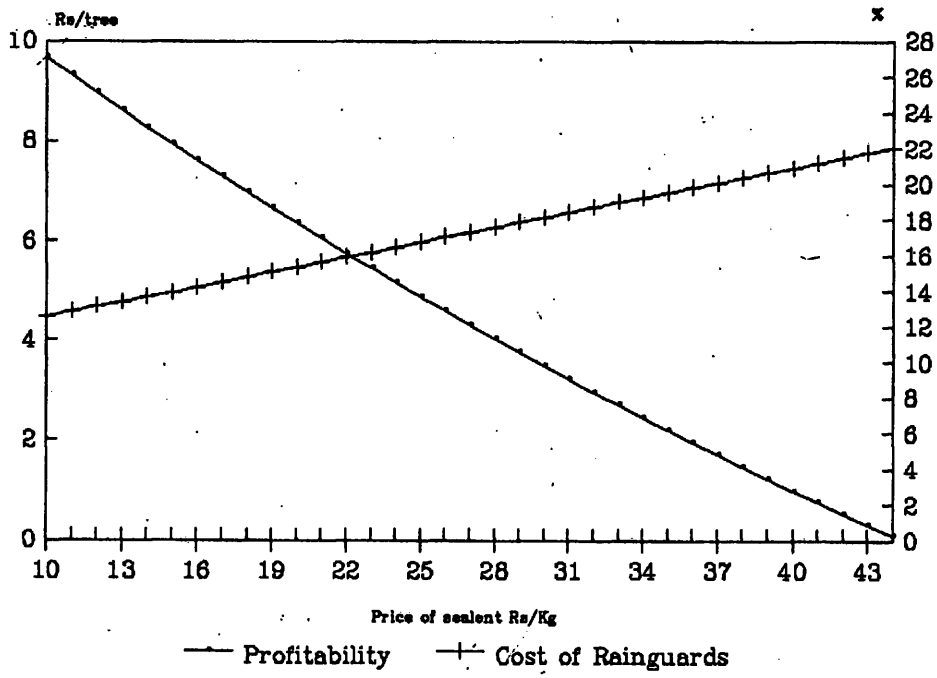

Fig. 7 Effect of sealent price on worthiness of apron type rainguards

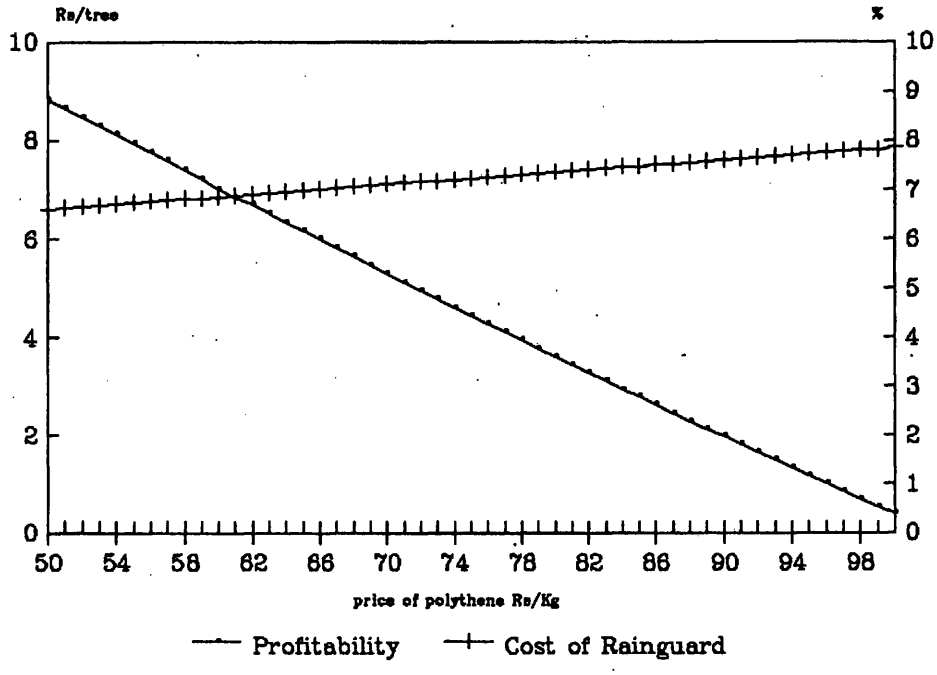

Fig. 8 Effect of polythene price on worthiness of apron type rainguards

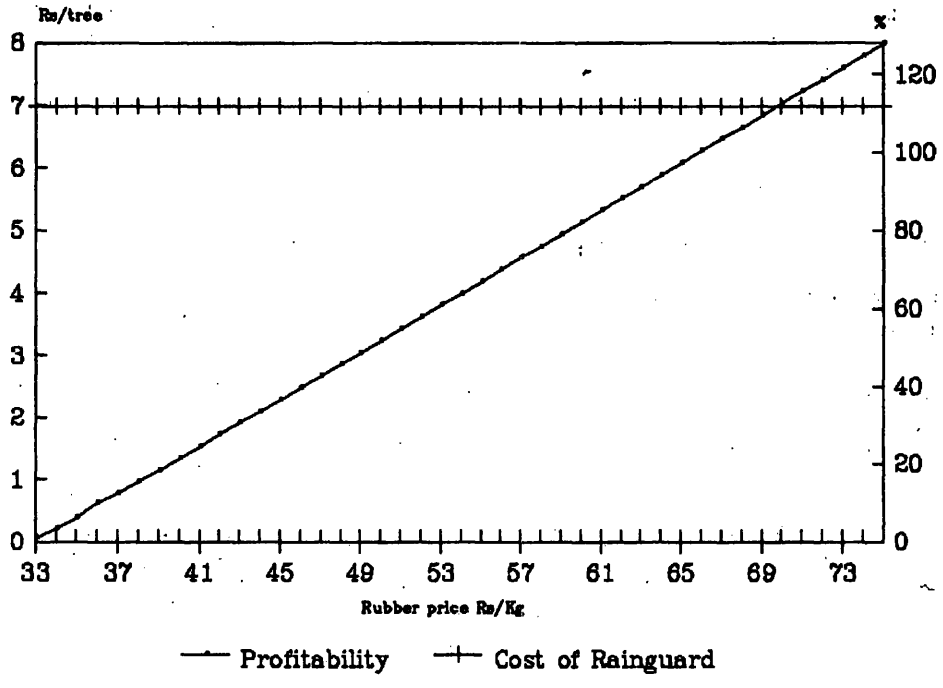

Fig. 9 Effect of rubber price on worthiness of apron type rainguards

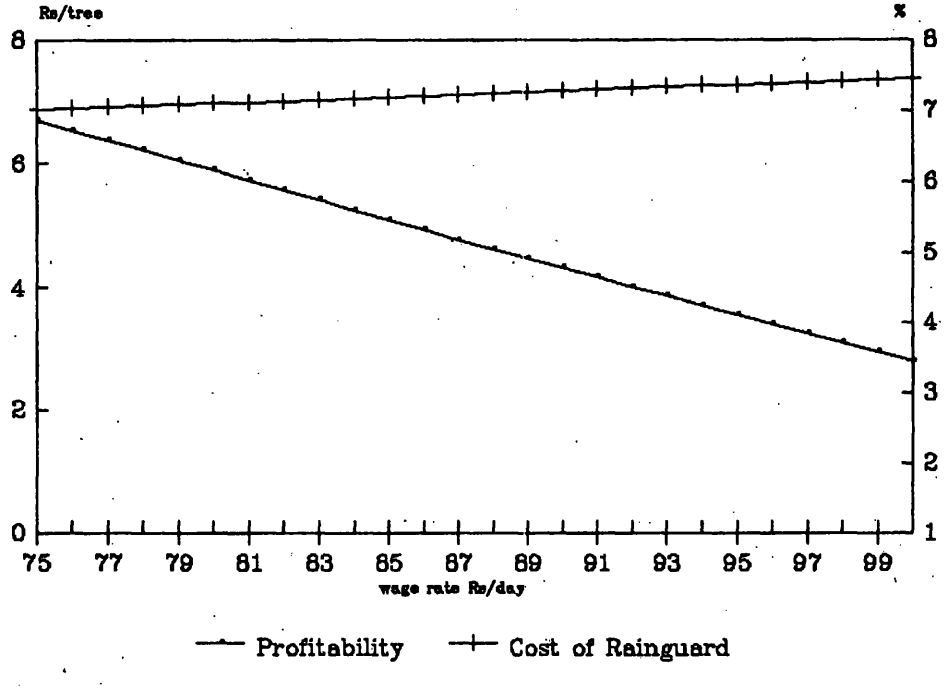

Fig. 10 Effect of labour wage rate on worthiness of apron type rainguards

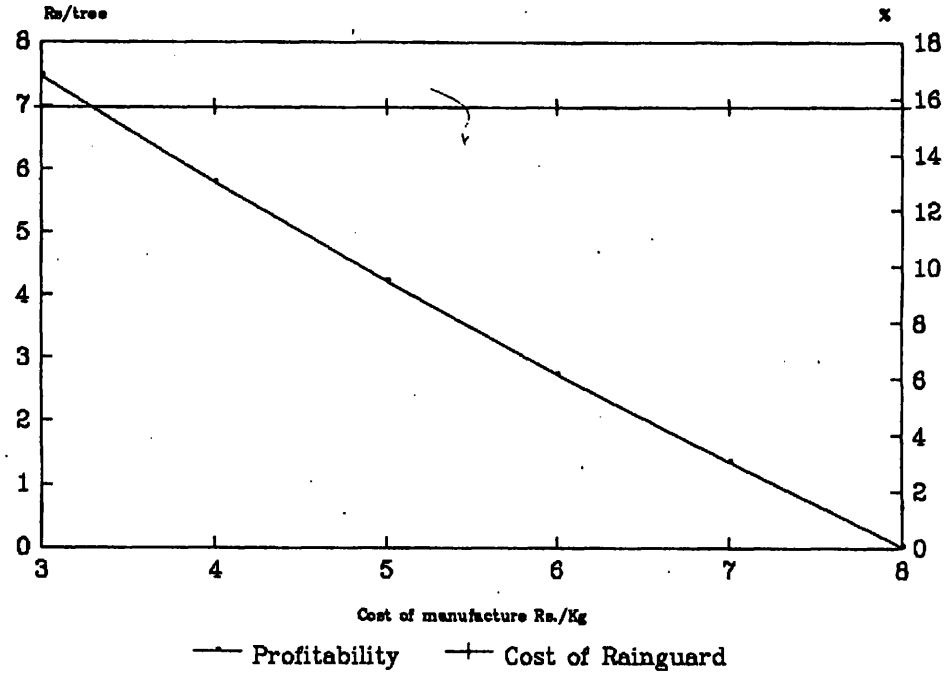

Fig. 11 Effect of cost of manufacture on worthiness of apron type rainguards

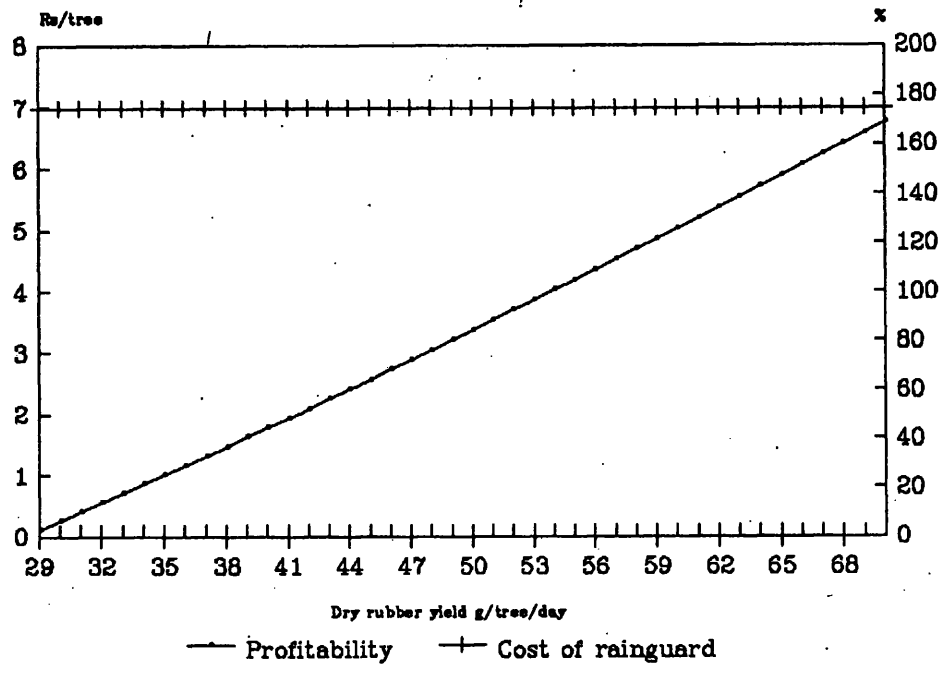

Fig. 12 Effect of dry rubber yield on worthiness of apron type rainguards

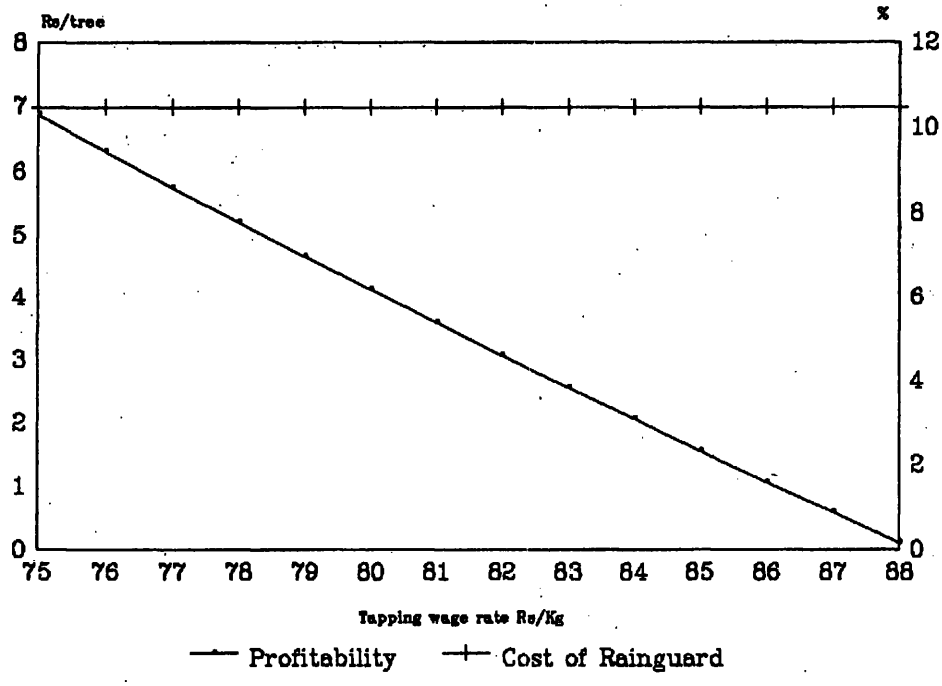

Fig. 13 Effect of tapping wage rate on worthiness of apron type rainguards

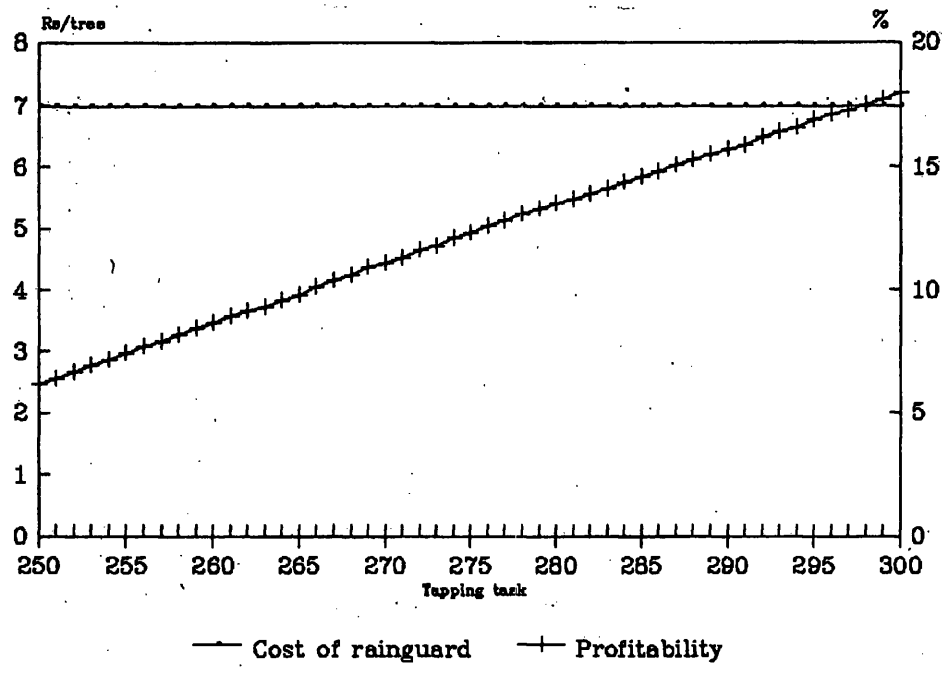

Fig. 14 Effect of tapping task on worthiness of apron type rainguards

Price of the sealent is also a major factor in deciding profitability of rainguard. Though the price of sealent is Rs.35/kg, the cost of manufacture (excluding any overhead charges) is less than Rs.20/kg. Therefore, if the methodology of preparing sealent is published and training on manufacture is provided, it would be more beneficial to the industry than allowing few people to have its authority.

Around thirty three percent of the rubber extent in Sri Lanka is under smallholder[2] conditions. Poor management practices under the smallholder level leads to poor yield levels. It is around 700 kg/ha/yr compared to 2000 kg/ha/yr at research level. Low price levels received due to market imperfection and the loss of tapping days appear to be the major reasons for poor management. Loss of tapping days makes the rubber plantations under smallholder level a part time enterprise. Most of the smallholders feel it is not a continuous income source (unpublished survey data, 1993). Nevertheless, most of them consider rubber as a stable and less risky crop. Rainguards in this regard is a useful innovation, as it will make rubber plantations a more stable and a continuous source of income.

Considering the contribution of the rubber plantations to the improvement and the protection of the environment, the innovation of rainguards is of global importance. The present detrimental effects to the environment, such as soil erosion, global warming *etc*, will aggravate, if not for the plantations like rubber. Hence, society as a whole benefits by any innovation that will make this industry more stable.

When considering the practical establishment of rainguards, risk and uncertainty prevailing in agricultural enterprises play a big role. Establishing rainguards specially in large scale leads to an increase in fixed cost of the plantation. According to Sandmo, 1971; Turnovsky, 1973; Wright, 1984 under uncertain conditions increase in fixed costs make the firm more risk averse since wealth is reduced.

Normally majority of the farmers are risk averse. Further, it was found by some studies (Sandmo, 1971; Just, 1974; Epstien, 1978) that low education levels make farmers more risk averse. As majority of farmers are less educated, they may be more risk averse toward this type of innovations, as the final out come is uncertain. This is due to the disutility for loosing anything is higher than the utility for any gain.

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[2]Smallholder: Smallholdings are held by the farmers whose main economic objectives is to maximize their family income. In addition to their land, family labour and own cash resources they might also use hired labour and borrowed capital. However, in contrast to estates they often have limited access to these resources dependent on local conditions.

Considering the risk aversion nature of farmers and the benefits of the rainguards, this study suggests to investigate the possibility of incorporating rainguards into the present subsidy scheme. Practically this might be done by diverting part of money presently allocated during the immature period to the rainguards. This may be required only for single year in early mature phase of rubber, thus growers can follow it later. As the present situation indicates a high and stable demand for the rubber wood in future, this suggestion will not have much negative effects. Because planters could partly depend on the income from the wood for replanting. Further, this approach will help to draw the attention of extension workers who do the subsidy inspection, towards mature rubber, which is presently lacking. According to Sandmo, 1971; Wright, 1984, usually risk reducing inputs are used more by the risk averse farmers in their programmes. Here, subsided rainguards could be considered as a less risky input for plantation.

While a subsidy could be useful in this regard, the extension workers will also have to play a major role. The extension staff must stress the fact that some of the economic activities considered to be profitable in the short run may not become profitable in the long run and vice versa. It is important for the extension worker to be familiar with such situations because discount rates and planning horizon for an individual and society are quite different. Society in general, is most likely to have longer planning horizons and smaller discount rates than an individual. Therefore, extension worker's message can be varied according to the characteristics of different economic elements of the society he is aiming at.

This situation can be used to implement and promote activities with priorities other than profit maximization. Most of the environmentally related activities go beyond the private interest. Further, the impact lasts frequently more than one generation. Extension work regarding rainguards should be motivated in this sense also rather than merely for financial gains.

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