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CONTRIBUTORY FACTORS OF COST OF PRODUCTION IN TEA SMALLHOLDING SECTOR OF MATARA DISTRICT

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Introduction and background

Tea remains the major plantation crop in Sri Lanka, which contributes to 14% of the total export earning in Sri Lanka (Anon, 2011a). Tea industry not only brings in much needed foreign exchange to the country but also provides the livelihood to a large number of people directly and indirectly. Low productivity, poor fertility status in soil and high cost of production (COP) are the major issues in Sri Lankan tea industry. It has been reported that the national productivity of tea lands of Sri Lanka in 2011 was 1615 kg MT per ha per year (Anon, 2011b). It is a far below the productivity levels of other major tea producing countries such as Kenya (1982) India (1700) and Turkey (1990) (Anon, 2010). Cost of production of tea is estimated as Rs. 269 per kg at national level which shows an increasing trend over the years and as a result profit margin is getting narrowed.

Sri Lankan tea industry is dominated by Smallholders in terms of production (70%) as well as extent (58%). It is often discussed that the increasing COP could not be tolerated by smallholders and as a result they are not investing for land development programs. Moreover, indiscriminate use of inputs such as fertilizers has led to high COP. Therefore, studies on COP in tea smallholding sector is of prime importance in order to make recommendations for managing tea lands in a profitable manner as their contribution is more than two third of the national production. On the other hand, there are new comers to the

industry who are establishing tea plantations without having proper knowledge on key cost components. They often find difficulties after investing huge cost which is currently estimated as 2.5 million per hectare (Jayakody and Shyamalie, 2002). Therefore, it is important that every tea grower has an idea on different cost components and their contribution to the overall cost.

Over 70% of the smallholdings are scattered in the Low country districts and this study confined to tea growing regions of Matara district where 17% of tea smallholdings are located (Anon, 2005). The objectives of this study were;

1. To establish the multinomial relationship between cost of production of green leaf and major attributes related to cost of production in smallholding sector in Matara district

2. To identify the key variables that the growers should manage in order to control the cost of production of green leaf.

Theoretical framework

End product of the tea smallholder is known as green leaf which becomes the raw material for manufacturing of made tea. Thus, the major cost components of a field that has been brought in to bearing are labour cost on harvesting, labour cost on sundry works (pruning, fertilization, weeding, chemical application *etc.*), cost on various inputs such as fertilizer and agro-chemicals and transport cost. Harvesting is the costliest operation in tea cultivation (Wijeratne, 2001). These cost components cannot be considered in isolation as each component could influence the behavior of the other and the total cost of production as well. Therefore, two prime factors *viz.* productivity and plucking intake are also incorporated in to the model.

Multinomial regression approach either non linear or multiple liner regression technique can be used to estimate the parameters. If multiple linear technique is used, the model is of the form of

$$Y_{ijkl....p} = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \ldots\ldots\ldots\ldots\ldots\beta_n x_n + \epsilon_{ijkl...p}$$

Where,

$Y_{ijkl....p}$	= Response variables (COP)
$x_1, x_2, x_3 \ldots\ldots x_n$	= Predictor variables
$\epsilon_{ijkl...p}$	= Error term

Parameters can be estimated using Ordinary Leased Square technique (OLS).

Sampling technique and field survey

The data used for this analysis was collected in 2005 by the Deniyaya Regional Station of the Tea Research Institute of Sri Lanka, covering all tea growing areas of Matara district which comprises 21 Tea Inspectors regions (TI regions). In that survey, data on various aspects related to cost of production of tea green leaves were collected using a structured questionnaire. The size of the sample was based on the proportion of the population of tea growers in the particular TI region (Strata) and the growers within the each TI region were selected on random manner (Stratified random sampling). Total number of growers surveyed in Matara district was about 900 (around 1.8% of the population) and after rejecting the incomplete and unreliable data a sample size of 841 was used for further analysis.

Measurement of variables

The independent variables considered were extent of holding, green leaf yield, quantity of fertilizer applied, price of fertilizer, other inputs used and their prices, number of workers employed on harvesting, number of workers employed for sundry work, wage rate of sundry workers and pluckers, and leaf

transport cost. Using above primary independent variables, following secondary independent variables were estimated for the model building.

Green leaf yield (Y) in kg per ha per year, Fertilizer quantity applied per unit green leaf yield (FPY), Other input cost in Rs. per ha (OIC), Plucker intake (PI) in kg (weight of green leaf harvested by a single worker), Number of sundry workers per ha (SWPH), Daily wage paid for a sundry worker per day per person (LCSW) in Rs., Daily wage paid for a plucker (LCPP) in Rs. per day, Leaf transport cost (TC) in Rs. per kg and Fertilizer price (FC) in Rs. per 50 kg bag. Dependent variable was Cost of Production of green leaf (COP) in Rs. per kg (total expenditure per weight of green leaf). Therefore, the model was built as follows;

$$COP = ß_0 + ß1\,(Y) + ß_2\,(FPY) + ß_3\,(OIC) + ß_4\,(PI) + ß_5\,(SWPH) + ß_6\,(LCSW) + ß_7\,(TC) + ß_8\,(LCPP) + ß_9\,(FC)$$

and the hypothesis was,

$H_0 = ß1 = ß_2 = ß_3 = ß_4 = ß_5 = ß_6 = ß_7 = ß_8 = ß_9 = 0$

H_1 = all betas are not equal to zero

The data were analyzed using SAS 9.1 and Minitab 14.1 statistical software.

Results and discussion

Multiple linear regression analysis has given the following model ($p<0.0001$).

$$COP = 6.78 - 0.000229\,Y + 19.4\,FPY + 0.000075\,OIC - 0.395\,PI + 0.0176\,SWPH + 0.0106\,LCSW + 1.04\,TC + 0.0430\,LCPP + 0.00353\,FC$$

All the parameter estimates of the model were significant ($p<0.0001$) and hence, all of them contribute to the COP significantly. Adjusted R-sq value (91.5%) indicated that selected variables adequately explained the COP. (variance influence factor-VIF was in between 1-1.4 thus multicolinearity does not exist among the independent variables). Type III SS values are given below.

Source	**Type III SS**
Y	667.645815
FPY	1487.784688
OIC	43.669169
PI	2347.678119
SWPH	930.104229
LCSW	188.796787
TC	109.165063
LCPP	396.889341
FC	101.929258

Type III SS value is higher for the variable, Plucker intake and thus the highest unique contribution to the model is given by the Plucker intake whereas lowest contribution is given by the variable, Other input cost (OIC). It is noteworthy that unique contribution of variable, quantity of Fertilizer applied (FPY) is also fairly high. The model shows that increase in yield in a unit area would decrease the COP. A minimum yield obtained in the study area was 1800 and the average yield was 10029 kg per ha per year. The equation shows that increase in yield from the lowest to the average level (*i.e.* from 1800 to 10029 kg per ha per year) would reduce the COP by Rs. 1.884* per kg (assuming that the other factors were constant) which gives a saving of Rs. 15,503* per ha per year only because of reducing the COP. Plucker intake has a negative relationship with the COP. It was found in this analysis that the increase in

plucker intake by just 2 kg would reduce the COP by nearly 80* cents per kg. The mean pluckers intake in the study area was 21.957 kg and many estates in the Low country achieve at least 25 kg per worker (Samansiri *et al.,* 2011) and hence, COP can be reduced by Rs. 1.20*, by increasing the plucker intake to the acceptable level.

Any increase of other input cost per ha (OIC), wages of sundry workers (LCSW), wages of pluckers (LCPP) and fertilizer cost (FC) would increase the cost of production. The COP is more sensitive to plucker wages than that of the other 3 variables considered. During the period of 2009/2010, smallholders in many part of the country have increased plucker wages by Rs. 100 per day. This would have resulted Rs. 4.30* increment of the COP. Giving incentive payments for the pluckers to harvest more crop (above the norm) is much more profitable than employing additional workers for plucking.

In the smallholding setup, daily wage of sundry workers are usually higher than that of pluckers. But it is important to note that the model coefficient of wage of sundry workers is 4 times lesser than that of pluckers and hence, its effect on reducing the COP is very much less than that of pluckers. Therefore, curtailing the important agricultural practices to reduce the COP is meaningless. The COP would increase at the same rate with increase in the transport cost. As subsidy is given for the fertilizer, there is no much impact of fertilizer on the COP. However, if the subsidy is removed, fertilizer price could be increased by about Rs. 2500.00 and the COP would increase by nearly Rs. 9.00 per kg of green leaf. Moreover, model also suggests that excessive application of fertilizer (over fertilization) would increase the COP.

Conclusions and recommendations

Cost of production of tea green leaf has strong linear relationships with productivity, quantity of fertilizer applied per unit yield, other input cost, plucking intake, number of sundry workers employed, daily wages of pluckers

and sundry workers, leaf transport cost and fertilizer price. Cost of production can be remarkably reduced by increasing land and labour productivity, especially the productivity of pluckers.

The COP is more sensitive to the wage of pluckers. Therefore, wage should not be increased in isolation without being linked to the plucking norm. Unnecessary curtailments of inputs or good agricultural practices do not have a significant bearing on reducing the COP and thus such effort should be avoided. If the fertilizer prices are adjusted to the market price, the COP would increase significantly and therefore, subsidy scheme should be further continued. However, over fertilization should be discouraged by supplying them with the recommended quantity, and through the extension programs.

Management implications

This study revealed that the COP could be significantly reduced by improving land productivity. Therefore, measures should be taken to increase the land productivity. Planting of high yielding cultivars and adoption of proper cultural practices would lead to high land productivity. In most occasions, farmers are reluctant to adopt good agricultural practices justifying that their COP would increase. But this study revealed that this is not true and that has no significant bearing on the COP. Therefore, all farmers should be encouraged to implement basic good agricultural practices such as sanitary pruning de-silting of drains etc that are heavily neglected. On the other hand, if the farmers do not undertake these vital agricultural practices, yield will be further declined and as a result, the COP would be further increased.

Moreover, other input cost also has a minimum effect on the COP. However, if such inputs have not gone to the field, the problems would be aggravated and consequently, very costly corrective measure need to be implemented (*eg.* applying chemicals to control diseases at the initial stage). Therefore, those other inputs which are not very costly should not be curtailed and given to the

field at proper time. Increase of pluckers' wages should be done in a rationale manner as it would otherwise, increase the COP by a greater amount. It is important to maintain a balance between two coefficients, PI and LCPP. In other words, maintaining this ratio close to 0.043/0.395 = 0.1 is very important. On the other hand, tea growers can introduce a piece- rate- basis remuneration scheme to pluckers, to reduce the COP.

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(Note: *These values are with respect to the wage rate for plucker in 2005/2006 period)