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Adoptability Of New Technology In The Small-Holdings Tea Sector In The Low Country Of Sri Lanka

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Abstract

The degree of adoption of recommended technology is a crucial factor in the tea small-holdings sector of the low country Sri Lanka as far as the yield is concerned. An empirical study was carried out to ascertain the present situation. Almost all the recommendations were grouped into 11 packages (selection of clones, fertilizer application, soil and moisture conservation, field establishment, training, infilling, weed control, pruning, shading, pest and disease control and plucking). A package consisted of sub indicators to reveal farmers' adoption level. High, middle, low and non-adopters were given justified scores (according to their importance to the yield). The total of marks given to sub indicators was the adoption index of farmers. Though the mean adoption level was 71%, some packages such as pest and disease control, and weed control were marginally adopted. Highest adopted packages included plucking, clone selection, field establishment, and fertilizer application (above 75% level). Adoption level was positively correlated to education, number of dependents, labour use pattern, and subsidies and further, it was negatively correlated to land extent.

Key words: adoption, correlation, packages, sub indicators, tea

1 Introduction

The per cent share of agriculture in the Sri Lankan Gross Domestic Product (GDP) was 15.5% (Central Bank, 2001). The tea sector contributed 2.2% to GDP in total and earned Rs. 61,602 million (US$ 690 million) from export products in 2001 (Central Bank, 2001). The total registered area under tea in 2001 was approximately 180,000 ha, of which 48% of extent was under small holdings and moreover, out of the total tea production, 62% comes from the small holding sector (Central Bank, 2001).

Ownership of tea cultivation in Sri Lanka is divided into three sectors viz. state holdings, large scale private holdings and small holdings. Up country tea estates are mostly state owned and well organized compared with low country plantations. The national average tea yield is around 1,786 kg per ha. This is well below the average yield of competing countries. As an example, the average yield of India is around 2,000 kg per ha (Central Bank, 2001). However, average yield of the smallholder sector was 2,212 kg per ha but in contrast, average yield for estate sector was only 1786 kg per ha.

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Annually a considerable sum of money is spent on tea research to undertake the process of technology generation. Based on such efforts, recommendations were developed and disseminated to the clients. However, the extent of adoption of these recommendations were a crucial issue. It seems that large tea estates have a positive adoption trend. But tea small holders' condition is not that clear. As large tea estates have an organized structure and necessary funds, they seem to be in a position to adopt new technologies. Although the extension services are functional, small holders' condition is not that comfortable to absorb new technology without incentives, because most of them are marginal farmers. Baruah *et al.* (1998) have studied the relationship between technology gap and six socio-economic variables. Results indicate a 19.97%-48.07% technology gap among the majority of tea growers. Further, educational qualifications and mass media exposure had a significant negative relationship with technology gap.

Most innovations which are available to farmers for adoption into their production operations are the results of organized research and development. They originate mainly from research conducted by universities and by public or private research organizations. Agricultural extension, by which technology is transferred, is an activity and a process which may be termed "communication", since "the key role of communication, in any form, is to plant new ideas in the minds of men" (Leagans, 1963). M-lmwere (1997) demonstrated that development of the tea smallholding sector can be achieved through intensive transfer of technology through extension, granting attention to in-filling, provision of fertilizer credit facility, supply of vegetative propogated materials, etc.

Knowledge on cultural practices, their attitudes and behavioral pattern, infastructural facilities, nature of the land ownership, irrigation methods, financial and credit facilities, economic conditions of farmers and the degree of use of new technology are the major factors varied from farmer to farmer. Among these, technology and extension services are the most prominent determinants of the productivity (Herdt and Capule, 1983). In a Kanyan study, results elucidate that technological innovations with close research-extension-farmer linkages, timely availability of credit to purchase inputs, sound mechanisms for loan recovery, guaranteed output market, etc provide success stories (Noor and Breth, 1995). Moreover, even with present technology, extension strategies have to be oriented to rational use of inputs, and extension efforts have deal with infilling, replanting and replacement planting (Hazarika and Subramanian, 1999).

The objectives of this study were to find out, the degree of farmers' adoption level, how they can be grouped into different adopter categories and to build up relationships between farmers, adoption level and independent variables such as age, education, land extent, etc.

2 Methods

Three small rural villages (Millawa, Aninkanda and Waralla) in Matara district (low country) of Sri Lanka were selected for the investigation and a sample of 90 farmers was drawn randomly. A field survey was conducted and the data were collected primarily by using a questionnaire. First, all the available agronomic practices (recommended by the Tea Research Institute, Sri Lanka) were divided into 11 main packages (clone

selection, field establishment, infilling, training (bush/plant), pruning, shading, plucking, fertilizer application, soil and moisture conservation, weed control, and pest and disease control). Then a justified weight was given to each package according to its importance to yield. In fact, the correlation between the different technical packages and yield was an assumption made on the technical competencies. Table 1 presents the weight allocation for each technical package and their contribution to adoption index. A main package consisted of several sub indicators. A sub indicator was the primary indicator of the adaptability of a specific practice. For each sub indicator farmers were given scores, according to his adoption level; high, middle, low and none. A farmer who practices the correct recommendation falls into the high adopter category and is given full marks. Deviators by 25% fall into middle adopter category whereas deviators by 50 % fall into low adopter category. The rest were non adopters and were given zero marks.

Table 1: Technical packages, allocation of weights and contribution to adoption index

	Technical Package	**Weight (%)**	**Contribution to adoption index as a percentage**
1	Selection of clones	100	13.8
2	Fertilizer application	93	12.8
3	Soil and moisture conservation	88	12.1
4	Field Establishment	75	10.3
5	Training (bush/plant)	65	8.9
6	Infilling	60	8.3
7	Weed control	58	8.0
8	Pruning	54	7.4
9	Shading	49	6.7
10	Pest and disease control	44	6.1
11	Plucking	41	5.6
	Total	727	100

3 Rationale for allocation of weights

The tea plantation started with seedling tea. Now newly selected clones are recommended and these clones, unlike seedling tea, surely give higher yields. The most striking way of increasing yields per acre is to replant with selected clonal tea (Sivapaln, 1986). So the highest score of 100 marks was given to the selection of clones. When essential elements like Nitrogen, Phosphorous, Potassium are removed with tea yield, unlike other packages, these elements must be supplied by artificial fertilizers. Otherwise yield tends to drop drastically. Works on nitrogen, phosphorus and potassium fertilizer applications, done by many scientists have extensively demonstrated their importance on yield (Mehta *et al.*, 1974; Marvah *et al.*, 1977). So this package was valued 2^{nd} most important and therefore 2^{nd} highest score of 93 was given to it.

Apart from clones and fertilizers soil and moisture conservation is a critical factor in tea culture. Sustainability of both tea culture and macro environment largely depends on it. So it was ranked 3^{rd} and the next highest score of 88 was assigned to it. Field establishment too is another important factor. It included spacing, planting hole dimensions etc. Once established a plant these parameters can never be changed. One has to do it correctly at the initial stage. So it was ranked 4^{th}. The total marks of all the sub indicators were 75.

Training too has to be done correctly at early stages of the plant and if it is incorrectly done, it will affect the yield and income throughout the life span of the tea plant. Therefore, it was ranked 5^{th}. The total marks of all the sub indicators were 65. Infilling has a great impact on yield. An important way of increasing productivity of a tea land is to adopt a properly worked out infilling programme (SIVAPALN, 1986). Less plants per acre, will give less yield. On the other hand, vacant areas will enhance weed growth and pest attacks. Infilling was ranked 6^{th}. The total marks of all the sub indicators were 60.

Weed control is also important. Profusing weed growth competes with the tea plant for soil moisture and nutrients. They smother tea plant and promote pest population. It was ranked 7^{th}. The total score was 58. Pruning has to be done from time to time. If it is not done at the correct time and to the correct method the plant starts deterioration. In fact, pruning in tea science can be regarded as a surgical operation in medicine. Tea bushes should be periodically pruned in order to maintain height, to stimulate vegetative growth and to maintain the frame of the bush (PETHIYAGODA, 1972; TUBBS, 1943; EDEN, 1958). Under Sri Lankan condition, shortage of skilled labour for pruning has became a limitation. Hence, tea Research Institute, Sri Lanka has introduced a motorized machine and a motorized machine and a research results indicate a six-fold increase in labour output (WIJERATNE, 2001). It was ranked 8^{th}. The total score was 54.

In low country areas two climatic factors; sunlight and temperature are considered too hard for the tea plant. Therefore shading is recognized as an important practice. The planting of shade trees and the maintenance of proper watershed is absolutely important for minimizing the drought effect of tea (SIVAPALN, 1986). So it was ranked at the 9^{th} place. The total score was 49. Pest and disease control is not that important, especially in the low country, compared with the other practices. In a way it does not seem to bother tea cultivators. It was ranked 10^{th}. The total score of the all sub indicators was 44. Plucking is a less important practice, compared with other practices. Therefore, it was ranked 11. The total score was 41.

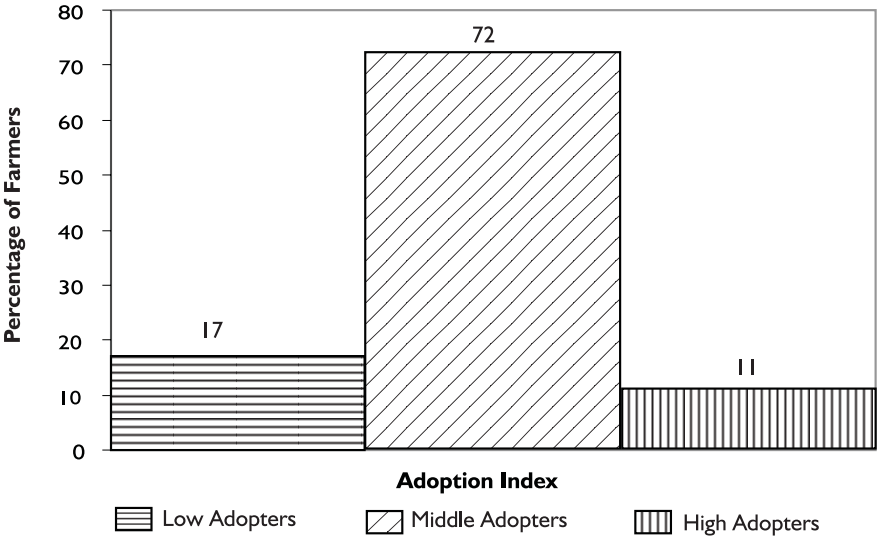
A farmer gets scores for recommendations in a technical package, according to the adoption level; high, middle, low, and none. The total of marks obtained by a farmer for all 11 packages indicates farmers' position in the adoption index. The adoption level of technical packages was calculated by averaging all marks obtained by farmers for a particular package.

A multiple regression analysis was done using the computer package SAS to determine the relationship between the adoption index and selected independent variables. Adopter categorization was done according to the standard adopter categorization procedure (ROGERS, 1983).

4 Results and Discussion

The mean adoption level in the research area was 71%. Adopter categorization is illustrated in Figure 1. Majority or 83% of farmers were in the middle and high adopter categories. This indicates that their adoption level was at a satisfactory stage. Such achievement may be attributed to the government extension service,, which was functioning well. A similar study carried out in the paddy sector by WIJERATNE (1988) revealed that there were 26% innovators, 60% middle adopters and 14% late adopters. Table 2 demonstrates the mean adoption levels of technical packages.

Figure 1: Adopter Categorization



X = 518, SD = 57

Plucking is done at least once a week. It is a regular practice and the farmers adopt the correct expertise through practice. The higher level of adoption of packages such as clone selection, field establishment and fertilizer application could be attributed to the favorable extension service, high price received for farmer produce, and nature of regular income generation. A low adoption level was visible in the packages such as infilling, shading, training, pruning, soil and moisture conservation and weeding. The impact of these practices on the yield is not visible in the short run. Therefore, farmers concentrate more on other packages, which they think are more important. However it is important to grant attention to soil and moisture conservation throughout the life

Table 2: Mean adoption levels of the technical packages

	Technical package	Mean adoption level as a percentage
1	Plucking	98
2	Selection of clones	90
3	Field establishment	83
4	Fertilizer application	77
5	Infilling	71
6	Shading	68
7	Training	65
8	Pruning	60
9	Soil and moisture conservation	60
10	Weeding	59
11	Pest and disease control	38

span of tea plant. Hasselo and Sikurajapathy (1965) estimated that during a four year period of replanting 251 tones/ha of soil is lost due to erosion, as a result of poor soil and moisture conservation practices.

Pest and disease outbreaks are rare in low country. Hence, farmers merely neglect to practice control measures. On the other hand, farmers are reluctantly to apply precautionary techniques, as cost of production is high. However, it was recommended that precautionary measures should be taken against live wood termites, shot hole borer and blister blight in low country holdings (Tea Research Institute, 1986).

The study attempted to establish relationship between adoption index and selected variables by employing the regression analysis. Table 3 illustrates the results.

The results reveal that more educated farmers corresponded to a higher adoption index. Educated farmers understand innovations easily. Farmers with more dependents correspond to a higher adoption index. When farmers have more dependents they have to work more. On the other hand, when there are more personnel to work in their fields, more labour can be employed on farm practices.

Land extent has shown a negative relationship. Farmers with smaller holdings had a higher adoption index, because smaller holdings may be intensively managed. Subsidies had a positive effect. When farmers are given subsidies they tend to invest on farm practices. When more labour is employed on their fields' farmers adopt innovations more. This is quite understood, as more labour can intensify the work.

5 Conclusions

The technology dissemination in the Sri Lankan tea small holding sector is at a satisfactory stage. The mean adoption level of 71% reflects this. Further, this was supported by the fact that a majority or 83% of farmers fall into high and middle adopter categories. But tea smallholders merely neglect some important recommendations; pest and disease control and weed control for instances. Though, soil and moisture conserva-

Table 3: Relationship between adoption index and selected variables

Variable	Coefficient	Std. Error	t - value	Probability (2-tail)
Constant	403.952	19.649	20.558	0.000
Age	0.164	0.245	0.667	0.507
Education	5.204	1.778	2.926	0.004
Dependents	5.772	2.318	2.490	0.015
Land extent	-14.433	4.554	-3.169	0.002
Subsidies	43.744	8.480	5.158	0.000
Labour/acre	1.908	0.492	3.878	0.000

$R^2 = 0.622$

tion is one of the most important disciplines in tea cultivation, it was paid a moderate attention. As the long term sustainability of this sector depends largely on soil and moisture conservation, farmers should be encouraged to practice correct conservation measures. Simple practices like mulching of inter-rows with *Cymbopogen confertiflorus* (mana grass), *Tripsicum laxum* (guatemala), *Eragostris curvula*, etc. should be promoted. Mana grass and Eragrostis serve as effective mulching material (SANDANAM *et al.*, 1976).

Some packages like plucking, clone selection, field establishment, etc. are adopted at a higher level. By enhancing the adaptability of other packages especially marginally adopted ones, the productivity and income level of farmers can be improved. But some supporting services like transport system, government subsidy schemes and crop insurance schemes should be initiated to achieve this task.

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