**RESEARCH ARTICLE**

# Impact of organic farming on annual average income and cost of production of tea smallholders in Sri Lanka

**R.A.P.I.S. Dharmadasa[a]*, R.G.P. de Silva[a], H.V.P. Wijewardhana[b], S.S. Vithanage[b]**

[a]*Department of Export Agriculture, Faculty of Animal Science and Export Agriculture, Uva Wellassa University, Passara Road, 90 000, Badulla, Sri Lanka*

[b]*Technical Service Division, Industrial Development Board of Ceylon, 10 400, Moratuwa, Sri Lanka*

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*Correspondence: sampath@uwu.ac.lk

***ABSTRACT***

*Sri Lankan government has planned to extend and promote organic tea cultivation in Sri Lanka through Haritha Lanka Programme which is the national cooperate plan to greening the Sri Lankan economy. Though positive environmental impacts of organic farming have been proven limited studies have been carried out in Sri Lanka to find out the impact of organic farming on the average annual income and cost of production (COP). Therefore, this paper attempts to examine the impact of adopting organic farming on annual average income and COP in high grown organic tea smallholdings (TSHs) in Sri Lanka. The data for the study were collected from a sample survey of 107 TSHs in four Grama Niladari divisions of Bandarawela secretariat of Badulla district. The study used two sample pooled t - test to identify the possible impact of adopting organic farming on two economic variables: annual average income and COP of TSHs. Ordinary Least Squared (OLS) estimate of a multiple linear regression was performed to estimate the impact of organic tea cultivation on the income and expenditure. The results suggest that the adoption of organic farming has strong positive impact on annual average income of TSHs while there is no significant impact of organic tea cultivation on cost of production and other off–farm income generations. The regression results further reveal that the annual average on–farm income of organically cultivated land is considerably higher than the non-organic TSHs in the study area. These findings conclude that adoption of organic farming improves the productivity of cultivated land, income and profit margin of the TSHs while maintaining the environmental sustainability.*

***Keywords****: Organic farming, tea smallholdings, average annual income, cost of production*

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## INTRODUCTION

Over the past centuries, agricultural practices in the world have changed with the industrial revolution and the introduction of chemicals as fertilisers and pesticides. With that, the agricultural yield has significantly increased and the agricultural products have got a better appearance. However, it is a fact that those chemicals produce residues in agricultural products and also cause soil and water pollution. At present, most of the surface and ground water supplies are contaminated with chemicals which were used to improve the agricultural productivity. With the awareness of these adverse effects, present day consumers are demanding on organically farmed products (Perera *et al.*, 2007). Accordingly,

the role of organic agriculture in providing food and income is gaining wider recognition around the world (Van Elzakker *et al.*, 2007).

Similarly, many governments and global institutions such as United Nations Environment Programme (UNEP) have recognised organic agriculture as an economically viable and environmentally sustainable form of agricultural production (UNEP, 2011). Accordingly, the Sri Lankan government has also planned to vitalise the organic farming in Sri Lanka through Haritha Lanka Programme (HLP) which is the national cooperate plan to greening the Sri Lankan economy (National Council for Sustainable Development, 2009). The Programme operates with 10 missions and aims to mainstream the subject of 'Environment' into the national development planning process. HLP addresses the sustainable growth of all the key sectors of Sri Lankan economy, including the tea industry.

Through the HLP, Sri Lankan government has implemented several green initiatives in tea industry to align its growth towards sustainability. Major Green Initiatives (GI), which have been implemented in Sri Lankan Tea Industry through the HLP, are listed below. Either initiation or promotion of these good practices is intended by HLP.

- Organic tea cultivation
- Establishing renewable energy plants based on tea estates
- Ozone friendly pure Ceylon tea certification system

In Sri Lanka, organic farming with the proper standards was initiated in 1979 by a non-governmental organisation, namely, "Gami Seva Sevana" (Jayakody, 2001). In 1980s organic cultivation practices were introduced to the tea cultivation in Sri Lanka becoming the world's pioneer in organic tea cultivation. Today organic farming is practiced in both tea smallholding (TSH) and estate categories in Sri Lanka.

Organic tea cultivation has been practiced only in 0.7% of the total tea cultivated area of Sri Lanka by 2010. This implies that still the cultivated area is almost negligible when compared with the total tea cultivation extent in Sri Lanka (SLTB, 2010). According to SLTB (2010), 52% of certified organic tea lands is scattered in up grown region (above 1,220 m) while remaining 48% of land extent is situated in mid grown (610 – 1120 m) region. No records are found related to the existence of organic tea cultivation in low country region. According to various issues of statistical bulletins of Sri Lanka Tea Board (SLTB), Sri Lankan total bio tea production has been fluctuating within the range of 930 – 1250 t. Sri Lankan bio tea industry has mainly dominated by the estate category rather than the tea small holders. Fettersso estate, which is managed by the Bogawanthalawa Plantations PLC, was the largest individual bio tea producing estate in 2010 and possessed 30% of organic tea out of the total production. Venture and Idulgashinna estates, which are managed by Stassen group of Companies, have

contributed to 31% of total production. Small farmers' organisation (SOFA) tea small holder group, which has mutual alliance with Bio Foods (Pvt.) Ltd., has made 18% of the 2010 bio tea production. Of the latter, 15% of the production has been made by the Greenfield estate which is managed by Lanka Organics (Pvt.) Ltd. Other estates such as Needwood, Koslanda and Finley Green have contributed 6% of the production.

Ozone friendly pure Ceylon tea certification scheme was introduced by Sri Lanka Tea Board in May 2011 with the objective of encouraging the eradication of methyl bromide and other ozone layer depletion substances which are used in agricultural pest management, product storage, warehousing, quarantine and pre shipment (QPS) purposes from the Sri Lankan tea industry, as emphasised in Montreal protocol. After four months of initiation, at the end of August 2011, 24 companies have applied to the certification scheme and 19 of them have got the certification while other five companies have been undergoing the verification process. Three companies have been entered in to the certification scheme within the first month of implementation. Thereafter, 16 new companies have got the certification in next three consecutive months.

Even though the positive environmental impacts of organic farming have been proven no study has been carried out yet to find its economic viability at the small holding level in Sri Lanka. Hence, findings obtaining from a study will be beneficial to prove the economic viability of organic farming. Also, it will be useful in crafting strategies during the process of extensive dissemination of organic farming among the small agricultural holdings in Sri Lanka. Therefore, this paper attempts to bridge the existing knowledge gap by examining the impact of adopting organic farming on the average annual income and the cost of production (COP) of the high grown organic tea small holdings in Sri Lanka.

## METHODOLOGY

### Study area and sampling method

Tea cultivated lands in Sri Lanka are mainly classified in to three elevation categories, namely high grown, medium grown and low grown (Sri Lanka Tea Board, 2011). Among them, this study focused on the high grown (above 1220 m) organically certified TSHs of Sri Lanka which are located in Wiharakele, Aluthwela, Pahalakadurugamuwa, Jayaminpura, Diyathalawa Grama Niladhari Divisions that belong to Haputale Divisional Secretariat Division.

Two strata could be identified in the selected study area with respect to the cultivation method namely organic and non-organic TSHs. Thus, stratified random sampling was used to select a representative sample which represents approximately 25% of the total population. Sampling procedure is shown in Table 1.

**Table 1:** Sampling procedure.

| Cultivation practice | Population size | Sample size |
|---|---|---|
| Organic | 184 | 47 |
| Non-organic | 233 | 60 |
| Total | 417 | 107 |

## Hypotheses and data collection

Hypotheses were designed to test the impact of adoption of organic farming on tea small holders' annual on-farm average income, annual off-farm average income (income generated from other sources except tea cultivated land) and annually incurred regular costs of the TSH. Data collection was carried out by using a pre-tested questionnaire which was constructed based on the data required to test hypothesises of the study. The following hypotheses were tested.

### *Hypothesis 1*

$H_0$ = There is no significant difference between annual income per acre of $GI_1$ (possession of organic certification) adapted TSHs and non-adapted TSHs

$H_1$ = There is a significant difference between annual income per acre of $GI_1$ adapted TSHs and non-adapted TSHs

### *Hypothesis 2*

$H_0$ = other off–farm annual family income has not significantly changed due to the adherence to $GI_1$

$H_1$ = other off–farm annual family income has significantly changed due to the adherence to $GI_1$

### *Hypothesis 3*

$H_0$ = There is no significant difference between annual regular costs of $GI_1$ adapted TSHs and non-adapted TSHs

$H_1$ = There is a significant difference between annual regular costs $GI_1$ adapted TSHs and non-adapted TSHs

## Data Analysis

In achieving the objectives, data were analysed using two sample pooled t-test, multiple linear regression models and Wilcoxen sign rank test. More specifically, two sample pooled t-test was initially used to identify the significant impact of adopting organic farming on the annual average on–farm income generations and COP of TSHs. Since actual figures of the pre-adoption period was not properly recorded by the farmers, influence of adopting organic farming on other off–farm income generations were measured based on the attitude of cultivators by using 5 point ranked scale which extended from –2 to 2 (if highly decreased = –2, slightly decreased = –1, no change = 0, slightly increased = +1, highly

increased = +2). Hence, Wilcoxen sign rank test was used to identify the impact on other off–farm income generations. If pooled t-test results or Wilcoxen Sign Rank test found to be significant, OLS estimates of a multiple linear regression was performed to measure the impact of organic farming on the annual average on-farm income and COP of TSHs.

Empirical model for on–farm per acre annual average income of TSH was initially consisted eight potentially relevant predictor variables as shown in Table 2. Then, backward elimination stepwise regression technique was used to select the best subset of predictor variables (Shaw *et al.*, 1994). This method handles the co-linearity problem better than other stepwise techniques. The most suitable model was selected based on the magnitude of adjusted $R^2$ value (coefficient of determination) and the range of errors of the predicted variable (Peiris *et al.*, 2008). In addition, Attua (2008) and Cross *et al.* (2008) have also followed the same procedure when selecting the multiple linear regression model with the best subset of predictor variables. In identifying the impact of organic farming initiatives on on–farm income and cost of production, separate two regression models are run taking the income or the expenditure as the dependent variable only if the results of the hypothesis tests are significant.

**Table 2:** Description of variables in the empirical models.

| Notation | Variable | Remarks |
|---|---|---|
| $GI_1$ | Green initiative 1 (Dummy variable ) | Dummy variable indicating the possession of organic certification, if possess = 1, otherwise = 0 |
| YLD | Yield | Kilogram per acre |
| AGE | Age of the tea small holder | Years |
| EXP | Farming experience | Years |
| FAM | Family size | Number of members |
| CONTRI | Contribution of tea land income to Total Family income | Percentage |
| OTHIN | Total annual family income which obtained apart from TSH | Rupees |
| EXT | Size of the TSH | Acres |

$$\text{ANIN\_AC or EXP} = \beta_0 + \beta_1 GI_1 + \beta_2 AGE + \beta_3 YLD + \beta_4 OTHIN + \beta_5 EXP + \beta_6 FAM + \beta_7 CONTRI + \beta_8 EXT + \varepsilon_i$$

where, $\beta_0 - \beta_8$ — Coefficients & $\varepsilon_i$ — Error term

Dependent variable of the model, annual income per acre of TSH (ANIN_AC) or expenditure was measured in rupees.

## RESULTS AND DISCUSSION

This section attempts to present the results of the data analysis while discussing major finding briefly. In analysing the data, we first tested the hypothesis laid down and based on the significance of them, impact of organic cultivation on TSHs was determined using a regression model. Thus, Table 3 presents the results of the two sample pooled t-tests and Wilcoxen sign rank test. According to the results of the table, adoption of organic farming has significantly ($P$<0.05) affected the annual average on–farm income generation of TSH. Hence, OLS estimates of multiple linear regression was performed to measure the impact on annual on–farm income generation. Results of the Table 3 further suggest that there is no significant difference in off–farm income and COP between the farmers who cultivate organic tea and the farmers who cultivate other teas. In the case of high grown tea estate category, adherence to organic farming has led to increase the COP. Higher labor cost and additional annual inspection cost mainly caused to increase the COP in the tea estate category (De Silva *et al.*, 2011). But, the result of this study reveals that adoption of organic farming has not significantly influenced the COP at the TSH level. According to the United Nations Economic and Social Commission for Asia and the Pacific (UNESCAP), in Sri Lanka, group certification of organic small holder farmers is commonly practiced by the certifiers (UNESCAP, 2002). It is also evident that group organic certification schemes can reduce organic smallholder farmer's individual costs (Giovannucci, 2007). Further, smallholder farmers usually use family labor for the farming activities. These reasons may influence to result the neutral impact on COP at the high grown TSH category in contrast to the high grown tea estate category in Sri Lanka.

**Table 3:** Results of two sample pooled t-tests and Wilcoxen sign rank test.

| Comparison | *P* value |
|---|---|
| Comparison of annual average on–farm income of two production systems (pooled t-test) | 0.000 |
| Comparison of COP of two production systems (pooled t-test) | 0.219 |
| Comparison of other off–farm income generations in before and after adopted to organic farming (Wilcoxen sign rank test) | 0.610 |

As there is a significant different in income levels of organic tea smallholders and others, a multiple linear regression model was run to find the impact of adoption of organic cultivation. Results of OLS estimates of multiple linear regression which performed to estimate the impact of organic farming on annual on–farm income generation are presented in Table 4. According to the results, among the eight predictors, experience in tea cultivation, age of the farmer, and family size were found to be insignificant indicating that those predictors do not influence

the annual on–farm income generation. It is a fact that the experience in tea cultivation may result an increase in income from tea cultivation. However, the concept of organic tea production is new to the smallholders. Therefore, their income may not increase due to the experience.

**Table 4:** Initial regression analysis results for annual average on–farm income generation at TSH level.

| Predictor | Coefficient | T Value |
|---|---|---|
| CONSTANT | 6152** | 2.73 |
| $GI_1$ | 67534*** | 3.26 |
| YLD | 54.7*** | 3.87 |
| OTHIN | 0.133** | 2.44 |
| AGE | - 52.9 | 0.08 |
| EXT | 271.33** | 2.37 |
| EXP | 485.5 | 0.74 |
| FAM | –1556 | 0.85 |
| CONTRI | 2967.5*** | 9.17 |
| R-Sq(adjusted) = 72.9% | *P* = 0.000 | N = 107 |

Note: ****P*<0.01; ** *P*<0.05; * *P*<0.10

Further, initial regression results were subjected to backward elimination stepwise regression technique to select the best subset of predictor variables and following results were obtained (Table 5).

**Table 5:** Regression results (after subjected to stepwise backward elimination) for annual average on–farm income generation at TSH level.

| Predictor | Coefficient | T Value |
|---|---|---|
| CONSTANT | 9342** | 2.43 |
| $GI_1$ | 68458*** | 3.11 |
| YLD | 59.8*** | 4.37 |
| OTHIN | 0.376** | 2.52 |
| EXT | 253.78** | 2.34 |
| CONTRI | 2897.5*** | 7.56 |
| R-Sq(adjusted) = 70.6% | *P* = 0.000 | N = 107 |

Note: ****P*<0.01; ** *P*<0.05; **P*<0.10

According to the results of Table 5, $GI_1$ (if organic = 1, otherwise = 0) has significantly influenced on the average annual income of TSH. Calculated coefficient of $GI_1$ is significant at 1% significant level (*P* = 0.000). It reveals that adoption of organic farming has increased the annual average income by Rs. 68,458.00 when other factors are constant. Typically, organically cultivated green leaves receive premium price while conventionally cultivated green leaves receive fairly low unit price. This is the major reason for significant increase of the annual average income in organically cultivated tea small holdings.

Other than the $GI_1$, results reveal that other family income, yield and contribution of tea land income to the family income also significantly influence the average annual income.

## CONCLUSIONS

Although, Sri Lanka is very popular in the world as one of the oldest tea producers having the brand name of 'pure Ceylon tea', Sri Lanka is still lagging behind with value addition and producing specialty teas. It is also a known fact that organically produced teas have higher demand in the world market and earn a premium price, the organic tea production is very low. However, as there is a trend that tea smallholding sector also attempts to adopt organic tea cultivation; this study attempted to find its impact on the smallholders. The results reveal that organic tea production leads to increase the income of the households. Therefore, as a country we must promote the organic tea production and it should be popularised among tea smallholders as their productivity is very high in comparison to estate sector's productivity and they contribute more than 70% to the overall production. One of the major problems in Sri Lankan tea industry is the high cost of production. Therefore, the estate sector as well as smallholder sector always seek solutions to the problem of high cost of production. In this study, we attempted to find out the impact of organic tea cultivation on the cost of production. Our results suggest that adoption of organic farming has no influence on the regularly incurred annual expenditures of cultivated land and other off–farm income generations. This finding further highlights the fact that the difference in cost of production between tea smallholders who produce organically and others who produce using other means such as chemical fertilizers in their production is not significant. Both type producers incur the same cost levels.

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