# Awareness, Knowledge and Adoption of Agricultural Technologies by the Corporate Tea Sector in Sri Lanka

V S Sidhakaran

(*Advisory and Extension Division, Tea Research Institute of Sri Lanka, Talawakelle, Sri Lanka*)

**ABSTRACT**

Like in any other sector, application of scientific agricultural knowledge and technology adoption in the tea is a vital investment to enhance productivity and overall performance of the tea industry. In view of this, a study was conducted in the up country region in 2008 to assess the awareness and knowledge levels of the managerial and supervisory level employees in the corporate sector tea plantations and to assess adoption/implementation levels of new technologies/practices. Findings of the study revealed that there was 19.41% of awareness gap and, 26.87% of knowledge gap between managerial and supervisory field staff of up country tea estates. The technology adoption level in the sector was 55% that means there existed 45% of technology adoption gap. These findings indicate that there is an urgent need of thought for a suitable/alternative technology transfer strategy to enhance the awareness, knowledge and adoption levels of supervisory staff and plantation workers in order to exploit the advantages of innovations generated by the TRI. Considering the various constraints faced by the present TRI technology transfer system such as dearth of staff, curtailment of funds and policy changes, there is an urgent need for a new suitable technology transfer strategy in order to meet the increasing technology needs of the gigantic corporate tea sector in the country, *"Pluralistic Technology Transfer Strategy"*, a multi stakeholder (government, private and non government organizations) collaborative technology transfer approach could be suggested as a feasible way out to address this issue.

**Key words:** Adoption gap, awareness gap, knowledge gap, and pluralistic technology transfer strategy

## INTRODUCTION

With the emergence of corporate sector tea plantations after the privatization of state owned plantations in early nineties, demand for high level of technological interventions through extension services has increased than ever before. The Tea Research Institute (TRI) is the apex body in the country, which undertakes research studies on all aspects of tea cultivation, processing and product development and delivers extension services for the tea sector. The TRI, being the primary source of technical information to the industry, its extension system holds the primary responsibility of disseminating scientific information and technologies to the sector and, it is the recognized source of technology and information, particularly for large plantations. The TRI extension system has launched numerous activities through various extension approaches to fulfill the extension needs of the corporate tea sector. However, there were no studies undertaken so far to evaluate the effectiveness of the TRI extension services rendered to corporate sector clients which was considered as the researchable problem. Hence, this study was conducted in 2007/08 with the objectives to assess the awareness, knowledge and adoption levels of TRI recommended technologies/practices in the corporate sector tea plantations.

## MATERIALS AND METHODS

### Study area and sampling procedure

The up country tea growing region had the majority number ( 37%) of corporate sector tea estates and major proportion (45% ) of the tea extent among the four regions (*Up country, Mid country, uva and Low country*) was purposively selected for the study due to the high concentration of corporate tea estates in the region. Sample survey method was adopted for the study. Out of the total number of 129 corporate sector tea estates in the study area, a sample of 60 estates was considered. First, the population was stratified into two as high yielding and low yielding estates and, 27 high yielding estates and 33 low yielding estates were finally selected for data collection based on proportionate random sampling method. Sixty Estate Managers and hundred and eighty Field Officers of the sampled estates were used as respondents.

### Data collection

Pre-tested interview schedule was used to collect data from the respondents. Data were collected by the author through personal interviews with the respondents and supplemented with secondary data from office records and field observations to validate data where ever necessary.

### Measurement of awareness, knowledge and adoption levels

Awareness was operationalized as the extent to which the respondents were known / heard of the innovations. Awareness level was measured on a two point continuum as 'aware' and "not aware" as followed by Suganthi (2004) with scores 2 and 1. The awareness index of a respondent was calculated by using the f ollowing formula.

$$\text{Awareness index} = \frac{\text{Score obtained by the respondent}}{\text{Possible maximum score}} \times 100$$

The awareness levels of respondents on the selected technologies were also analyzed in order to identify the technology wise awareness level.

Knowledge is defined as those behaviors and test situations which emphasized the remembering either by recognition or recall of ideas, materials or phenomena. Knowledge is one of the important components of behavior and it plays a vital role in the adoption of improved practices (Bloom *et al.* 1985). The knowledge was operationalized as the quantum of scientific information remembered by the farmers on TRI recommended technologies. Knowledge level was measured on a two point continuum as 'correct', and incorrect' with scores of 2 and 1 respectively. The scoring procedure adopted by Venkattakumar (1997) was used for this study. The knowledge index of a respondent was calculated using the following formula.

$$\text{Knowledge index} = \frac{\text{Score obtained by respondent}}{\text{Possible maximum score}} \times 100$$

Based on the scores, respondents (Estate Managers and Field Officers) were classified into low, medium and high in their knowledge level by using cumulative frequency method based on mean and standard error. The knowledge levels of respondents on individual technologies were also analyzed.

The innovations recently recommended by the TRI and disseminated by the extension and research systems were used for knowledge test. Critical questions to be asked under each selected innovations to test awareness and knowledge were formulated by further discussions and relevance of critical questions / points from client's perspectives. Difficulty and discrimination indices of knowledge items were calculated. Validity and reliability of the knowledge items were ensured by calculating relevant correlation coefficients and, based on those, 24 items for knowledge test were selected for the study.

Adoption was operationalized as the utilization and application of technologies/ practices recommended by the TRI, by the tea estate during the last cropping year. The extent of adoption refers to the hectarage in which a particular technology/ practice is adopted in a particular tea estate out of the potential extent (hectarge). The following scale developed by Bhutia (1975) was used to determine extent of adoption;

$$\text{Extent of adoption} = \frac{\text{Actual adopted extent}}{\text{Potential extent for adoption}} \times 100$$

Based on the field realities of large scale tea plantations, adoption extents of individual technologies/practices were classified into four categories and assigned a score accordingly (Table 1).

Table 1. Classification for the adoption extent of technology

| Sl. No | Adoption category | Extent of adoption | Score |
|---|---|---|---|
| 1. | Full adoption | More than 60% | 4 |
| 2. | Partial adoption | 20% to 60% | 3 |
| 3. | Less adoption | Less than 20% | 2 |
| 4. | Nil adoption | Nil | 1 |

In order to work out the overall adoption, adoption index for individual respondents were calculated using the following formula. For this purpose, twelve innovations recently recommended by the TRI were selected as explained in the proceeding paragraph.

$$\text{Adoption index} = \frac{\text{Score obtained by the respondent}}{\text{Possible maximum score}} \times 100$$

The adoption levels of individual technologies were analyzed to identify technology wise adoption levels using percentage analysis. Adoption mean scores were also calculated for individual technologies in order to further distinguish and compare adoption of individual technologies. The reasons for non adaption of technologies were listed out by discussing with clients prior to the survey and the list was then administered for response. The reasons for non adoption of individual technologies were quantified using percentages.

**Data analysis**

Data collected from the respondents were coded and assigned scores wherever required in order to make the data meaningful and, were subjected to analyze using the following analytical procedures with SPSS software package. Confidence interval method was used to work out cut off points for classifying the respondents into three categories as high, medium and low with respect to their knowledge and adoption levels. This was done based on mean (X) + or – 1.96 x Standard Error (SE) as suggested by Fisher (1935) and categorized the respondents as follows;

| | | |
|---|---|---|
| Low group | = | Below X – 1.96 x SE |
| Medium group | = | In between X – 1.96 x SE and X + 1.96 x SE |
| Low group | = | Above X + 1.96 x SE |

Cumulative frequency distribution and percentage analysis were used to quantify low, medium and high groups and to calculate index for awareness, knowledge and adoption.

Independent 't' test was performed to study the variation/ compare awareness, knowledge and adoption levels between Managers and Field Officers.

Ranking method was used to prioritize constraints based on mean scores/ percentages, suggestions and other aspects studied with respect to opportunities for private extension.

## RESULTS AND DISCUSSION

### Overall awareness of Estate Managers and Field Officers on TRI technologies

Table 2 reveals that majority of both the Estate Managers (62.5%) and Field Officers (60%) were aware of the twelve TRI technologies selected for the study, whereas 37.5% of the Managers and 40% of the Field Officers were not aware of all the twelve technologies which is a considerable proportion although not the majority.

Table 2. Overall awareness levels of Estate Managers and Field Officers on TRI Technologies

| Sl. No. | Category | Estate Managers Percentage | Field Officers Percentage |
|---|---|---|---|
| 1. | Aware of all the 12 technologies | 62.5 | 60 |
| 2. | Not aware all the 12 technologies | 37.5 | 40 |
| | **Total** | **100** | **100** |
| | Mean awareness index | 94.33 | 74.92 |
| | Mean difference (Gap) | 19.41 | |
| | 't' value | 2.015* | |

The mean awareness index of Estate Managers (94.33) was higher than that of Field Officers (74.92) with a difference of 19.41. The 't' value being significant at 5% probability level, it could be concluded that the awareness level of Estate Managers and Field Officers on TRI technologies differ significantly with a gap of about 20 %. The Estate Managers having better educational level, innovativeness, scientific orientation, contact intensity with the TRI and wide exposure to different communication channels coupled with having the primary responsibility of technology implementation could have been the reasons for higher level of awareness of Estate Managers than that of Field Officers.

### Technology wise awareness level

The technology wise awareness of Estate Managers and Field Officers was studied, analyzed and the results are presented percentagewise in Figure 1.

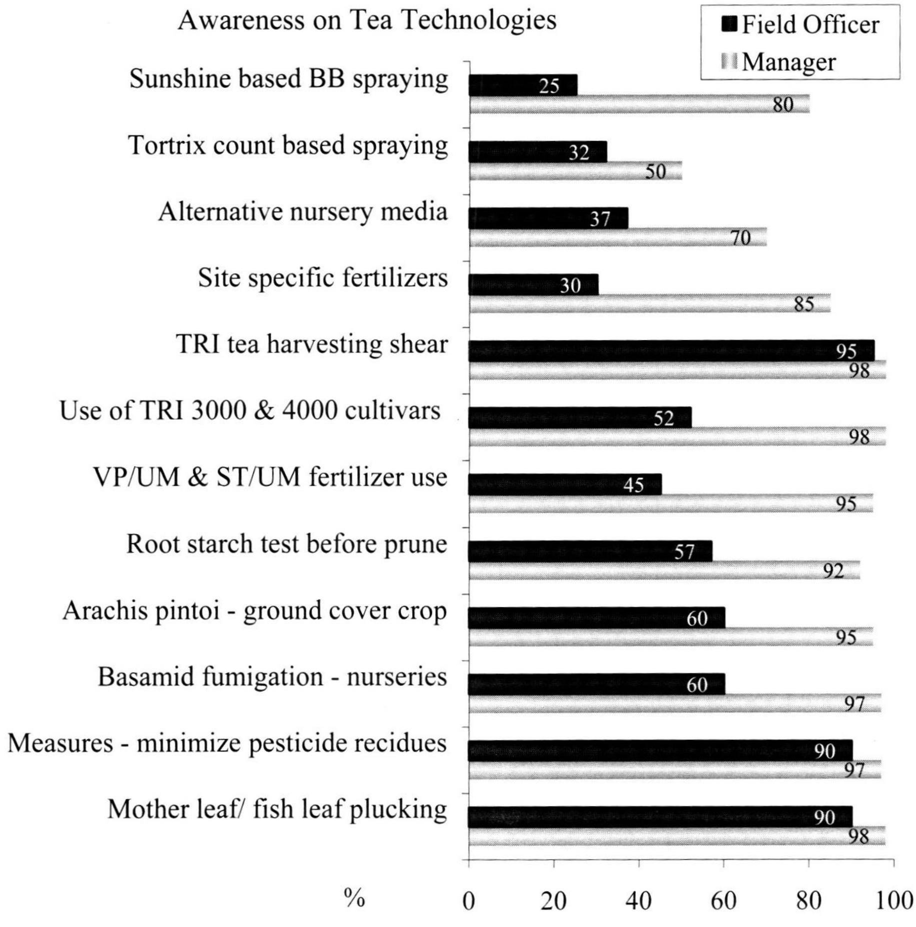



Figure 1. Technology wise awareness levels of Estate Managers and Field Officers

**Overall knowledge level of Estate Managers and Field Officers**

Table 3 reveals that 45% of Estate Managers and 30% of the Field Officers were in the high knowledge level category whereas 20% and 30% of the Estate Managers and Field Officers were in the medium level of knowledge respectively. Similarly 35% and 40% of the Estate Managers and Field Officers were in the low knowledge level category respectively.

The mean knowledge index of Estate Managers (78.54) was higher than that of Field Officers (51.67) with a difference of 26.87. The 't' value being significant at 1% level indicating that the knowledge level of Estate Managers on TRI technologies was higher than that of the Field Officers with a gap of about 27%.

Table 3. Overall knowledge levels of Estate Managers and Field Officers on TRI Technologies

| Sl. No. | Category | Estate Managers | Field Officers |
|---|---|---|---|
| 1. | Low | 35 | 40 |
| 2. | Medium | 20 | 30 |
| 3. | High | 45 | 30 |
| | **Total** | **100** | **100** |
| | Mean knowledge index | 78.54 | 51.67 |
| | Mean difference (knowledge gap) | 26.87 | |
| | 't' value | 2.869** | |

**Technology wise knowledge level of Estate Managers**

The technology wise knowledge level of Estate Managers and Field Officers were analyzed and the results are presented percentagewise in Figure 2.

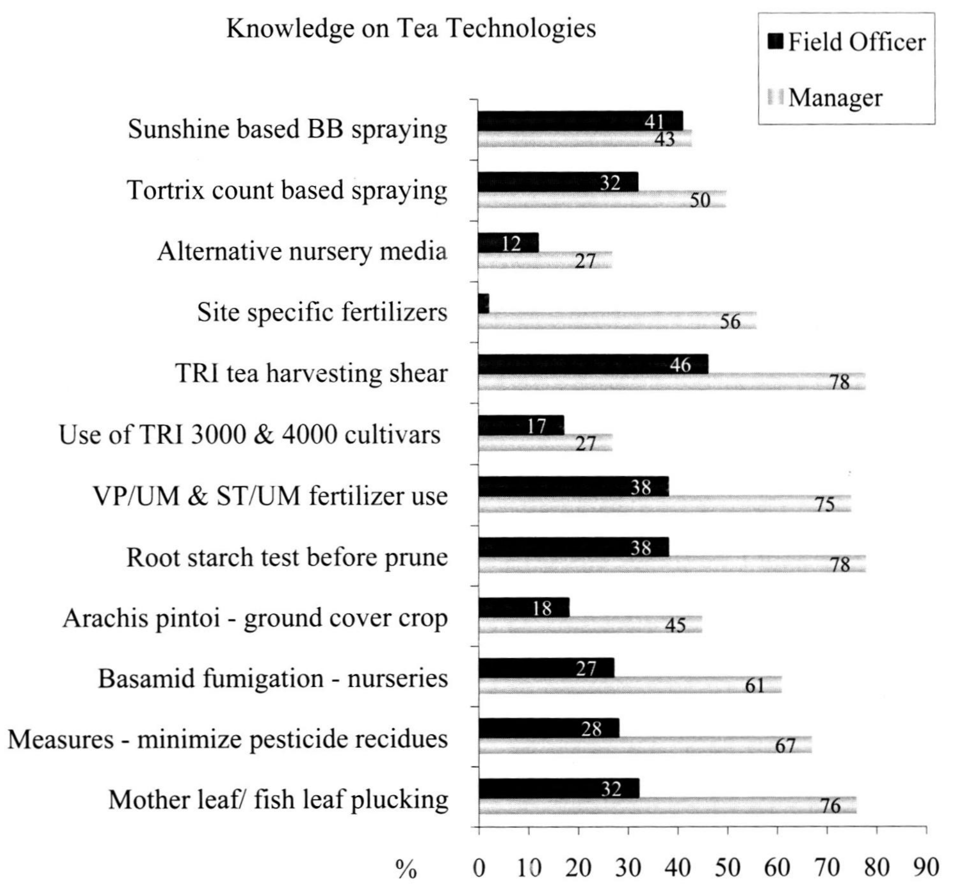



Figure 2. Technology wise knowledge level of Estate Managers and Field Officers

**Overall adoption of TRI technologies**

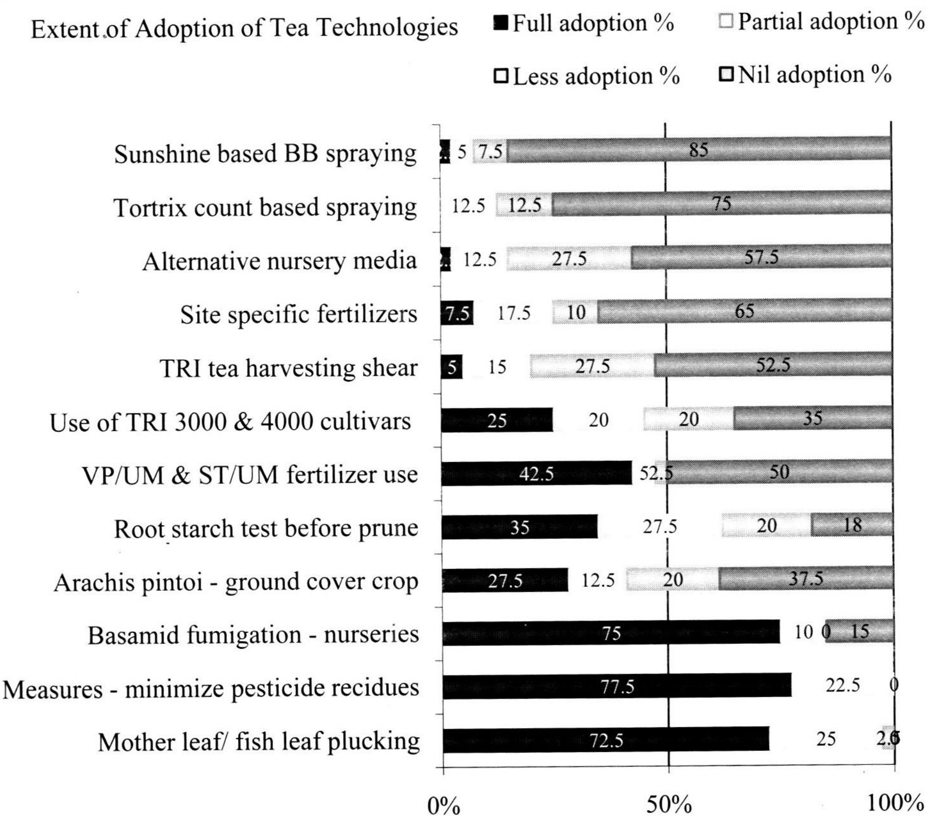
Table 4 indicates that greater proportion (42%) of the estates had low adoption while 38% had high level of adoption. Medium level of adoption was evident in 20% of the estates. Further, it shows that the mean adoption index (55) was in the higher side with technology adoption gap of 45%.

Table 4. Overall adoption levels of TRI technologies by the tea estates

| Adoption level | Percentage of estates adopted |
|---|---|
| Low | 42 |
| Medium | 20 |
| High | 38 |
| Total | 100 |
| Mean adoption index | 55 |
| Technology adoption gap | 45 |

**Extent of adoption of TRI technologies**

Adoption extents of the twelve TRI technologies by estates studied are presented in Figure 3.



The results show a wide variation among technologies with respect to their adoption extents. Furthermore, mean scores for adoption of the twelve technologies were calculated in order to distinguish and compare the adoption extent between technologies. The adoption mean scores were calculated for each of the technologies and they are arranged in the descending order of their mean scores and presented in Figure 4.

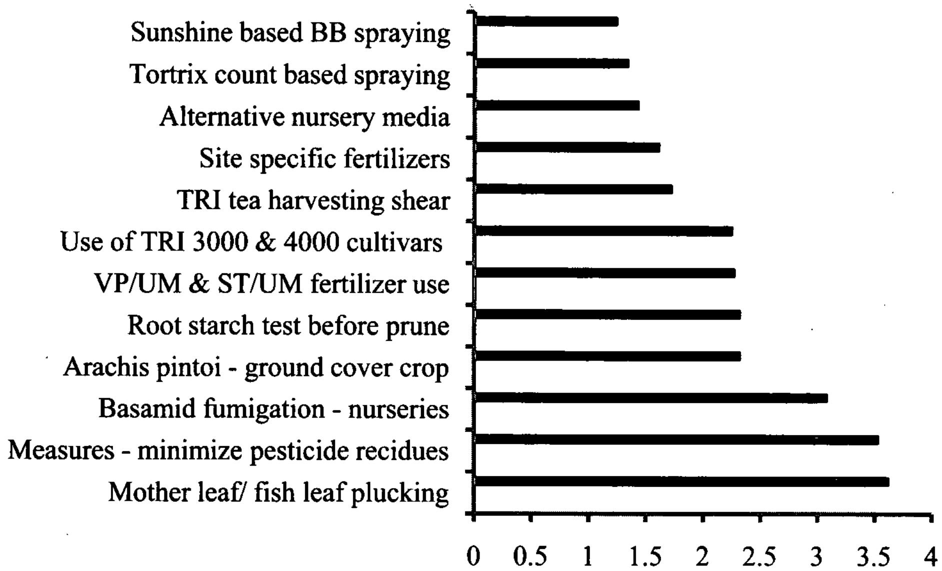



Figure 4. Distributions of TRI technologies according to their adoption mean scores (Maximum possible mean score = 4.00, Average mean score = 2.23)

Average mean score of the twelve technologies was 2.23. Hence it could be concluded that the adoption extent of the following five technologies out of twelve technologies were below average.

1. TRI tea harvesting shear
2. Site specific fertilization
3. Soil substitutes for tea nurseries
4. Tortrix counting method to schedule spraying
5. Sunshine based blister blight disease control schedule

**Reasons for less and non-adoption of TRI technologies**

Attempt was made to explore the reasons for less/not adopting the TRI technologies from the perspectives of Estate Managers and Field Officers. Among the many reasons for less / nil adoption of TRI technologies/practices, lack of awareness and interest on the technologies by the clientele system, poor performance of the technologies in field conditions and, current socio-economic situation, complex nature of some the technologies, recommended technologies not being within the policies of plantation companies, lack of skill and expertise to implement technologies at field level and unavailability of materials / equipments were the major reasons for less / nil adoption.

Table 5. Reasons for less and non-adoption of TRI technologies as perceived by the Estate Managers and Field Officers (n = 240)

| SI. No. | Technology / practice | Reasons for non-adoption | Percent |
|---|---|---|---|
| 1. | TRI 3000 and 4000 series cultivars | Planting material not available | 37.5 |
| | | Not seriously thought of | 19.0 |
| | | Not successful in frost/wind prone areas | 7.5 |
| 2. | Nursery fumigation using Basamid | Time consuming procedure | 9.0 |
| | | We do not fumigate mana soils | 5.0 |
| 3. | Soil substitutes for tea nursery | Have sufficient nursery soil | 50.0 |
| | | Poor growth | 19.0 |
| | | Not seriously thought of | 15.0 |
| | | Heat generation and difficulty in transporting plants | 15.0 |
| 4. | Pesticide residue maintenance in tea | Weed control without chemicals not possible | 6.0 |
| | | Blister blight control without chemicals not possible | 6.0 |
| 5. | *Arachis pintoi* as a ground cover crop | Lack of planting material | 20.0 |
| | | Not aware of | 16.0 |
| | | Wild boar attack | 9.0 |
| | | Poor growth in higher elevation | 7.5 |
| | | Compete with tea for moisture during drought | 6.0 |
| 6. | Root starch testing before prune | Not seriously thought of | 19.0 |
| | | Not aware of | 9.0 |
| | | Yield loss during rest period | 7.5 |
| | | Complex procedure | 6.0 |
| | | Compulsory resting as a policy | 6.0 |
| 7. | Tortrix counting method to schedule spraying | Complex procedure | 37.5 |
| | | Lack of expertise | 31.0 |
| | | Tortrix is not a major problem | 15.0 |
| | | Not aware of | 10.0 |

Contd.. page 64

| Sl. No. | Technology / practice | Reasons for non-adoption | Percent |
|---|---|---|---|
| 8. | VP/UM and ST/UM fertilizer mixtures | Not within company policy | 45.0 |
| | | Comfortable with previous fertilizer mixtures | 15.0 |
| | | U709 good and cost effective | 15.0 |
| | | Used and discontinued | 11.0 |
| | | Not seriously thought of | 6.0 |
| 9. | Site specific fertilizer | Not within company policy | 37.0 |
| | | Complex procedure | 19.0 |
| | | Used and discontinued | 19.0 |
| | | Not seriously thought of | 6.0 |
| 10. | TRI tea harvesting shear | Delaying plucking rounds | 44.0 |
| | | No plucker shortage | 31.0 |
| | | Poor leaf quality (half leaf) | 31.0 |
| | | Worker resistance | 19.0 |
| | | Crop loss | 15.0 |
| | | Used and discontinued | 12.5 |
| | | Extra time for sorting bad leaf | 7.5 |
| 11. | Sunshine blister disease control schedule | Sunshine recorder not available | 69.0 |
| | | Not aware of | 62.5 |
| | | Complex procedure | 60.0 |
| | | Not effective | 31.0 |
| 12. | Mother leaf and fish leaf plucking in proper | High plucking norm during lean seasons | 12.5 |
| | | Poor knowledge of pluckers | 12.5 |
| | | Hard plucking to control blister | 10.0 |
| | | Labour shortage | 10.0 |

## CONCLUSIONS AND IMPLICATIONS

Findings of the study reveal that there is a wide gap between Estate Managers and their supervisory staff in terms of awareness and knowledge in TRI recommended technologies/ practices. The technology adoption level in the sector is 55% which means that there is 45% gap in technology adoption in the corporate tea sector in the up country region.

The findings suggest the need of improving the present TRI extension system, to enhance awareness, knowledge and adoption levels of middle level supervisory staff including plantation workers in the corporate tea sector in Sri Lanka in order to exploit the advantages of innovations generated by the TRI. Considering the various constraints faced by the present TRI technology transfer system such as severe dearth of staff, curtailment of funds and policy changes *etc*. In view of meeting the increasing technology needs of the gigantic corporate tea sector in the country, there is an urgent need for introducing/ supplementing with a feasible extension approach. *"Pluralistic Technology Transfer Approach"*, a multi stakeholder (government, private and non government organizations) collaborative technology transfer approach could be suggested as a feasible way out to address this issue. Various technology dissemination models could be formulated based on factual data and such models should be tried out in pilot scale.

**ACKNOWLEDGEMENTS**

The author greatly acknowledge the Tea Research Institute and Sri Lanka Council for Agricultural Research Policy for financial support and, the Chairman and Advisory Committee for thesis research program of the author, Tamil Nadu Agricultural University, Coimbatore, India for their valuable guidance. The author expresses his sincere gratitude to all Chief Executive Officers of Plantation Management Companies, Estate Managers, Field Officers and Plantation Workers for their excellent cooperation extended towards conducting the field survey.

**REFERENCES**

Bhutia P 1975 A study on factors associated with differential adoption of HYV of paddy farmers of Sikkim. Unpub. Ph D Thesis: Division of Agricultural Extension, IARI, New Delhi.

Bloom M, Egalhalt E, Farst W Hill and Karathwool P R 1985 Taxonomy of education objectives. The cognitive domain, Longmans Green and Company, New York.

Fisher R A 1935 The Design of Experiments. Edinberg: Oliver and Beyd.

Suganthi N S 2004 Technological gap in cashew production. A critical analysis. Unpub. M.Sc. Thesis, TNAU, Coimbatore. 42-43.

Venkattakumar R 1997 Socio-economic analysis of commercial coconut growers. Unpub. M.Sc. Thesis, TNAU, Coimbatore

# INSTRUCTIONS TO AUTHORS

**Aims and Scope**

Sri Lanka Journal of Tea Science publishes full-length papers describing the results of original research and review articles dealing with tea related subjects. This area includes fundamental and applied aspects of agronomy, agro chemistry, agro physics, agro economics, biochemistry, ecology, entomology, ergonomics, mineral nutrition, plant water relations, nematology, pathology, soil biology, sociology, tea-extension, and technology. All contributions should be in English language.

**Manuscript Submission**

Manuscripts and figures should be submitted in electronic form together with a hard-copy printout (4-fold) to:

The Director
The Tea Research Institute of Sri Lanka
Talawakelle
Sri Lanka

Fax: 0094 52 2258229

The storage medium for electronic manuscript is a CD or a floppy disk preferably in MS Word. Please label the CD or floppy properly, giving exact details on the name(s) of the file(s), the operating system and software used. Always save the electronic manuscript in the word processor format that you use; conversions to other formats and versions tend to be imperfect. In general, use as few formatting codes as possible. As a precautionary measure, you should always retain a backup copy of your file(s). After acceptance, please make absolutely sure that you send the latest (i.e. revised) version of your manuscript, both as hard-copy printout and on CD or floppy.

**Manuscript Presentation**

The journal's language is English. British English spelling and terminology should be used. Manuscripts should be printed or typewritten on A4 paper, one side only, leaving adequate margins on all sides to allow reviewers' remarks (1.25" for top and left and 1" for bottom and right). The Times New Roman font and size 11 should be used. Please double-space all material, including notes and references. Quotations of more than 40 words should be set off clearly, either by indenting the left-hand margin or by using a smaller typeface. Use double quotation marks for direct quotations and single quotation marks for quotations within quotations and for words or phrases used in a special sense.

Number the pages consecutively with the first page containing:

- title
- author(s)
- affiliation(s)
- full address for correspondence, including telephone and fax number and e-mail address

**Abstract**

Please provide a short abstract of 100 to 250 words. The abstract should not contain any undefined abbreviations or unspecified references.

**Key words**

Please provide a maximum of 6 key words or short phrases in alphabetical order.

**Abbreviations**

Abbreviations and their explanations should be collected in a list. Abbreviations should be explained at first occurence. Only SI units and abbreviations should be used.

- For mineral contents the elements (P, N, K etc.) should be used
- Isotopes should be indicated as 14C, 32P etc.
- Ions should be mentioned as H+, Mg2+, etc.
- For normal or molar concentrations italic N and M should be used
- Latin biological names should be italicized

**Units**

Only SI units are acceptable.

**Submission of hard-copy figures**

If no electronic versions of figures are available, submit only high-quality artwork that can be reproduced as it is, i.e. without any part having to be redrawn or re-typeset. The letter size of any text in the figures must be large enough to allow for reduction. Photographs should be in black-and-white on glossy paper. Figures that are to be printed in black-and-white should not be submitted in colour. Colour pictures are accepted only in case where colour is essential.

Each figure and table should be numbered in Arabic numerals and mentioned in the text. The approximate position of figures and tables should be indicated in the margin of the manuscript. On the reverse side of each figure, the name of the (first) author and the figure number should be written in pencil: the top of the figure should be clearly indicated. Figures and tables should be placed at the end of the manuscript following the Reference section. Each figure and table should be accompanied by an explanatory legend indicated at the top or bottom of the figure or the table. In tables, footnotes are preferable to long explanatory material in either the heading or body of the table. Such explanatory footnotes, identified by superscript letters, should be placed immediately below the table.

**Section headings**

First-, second-, third-, and fourth-order headings should be clearly distinguished but not numbered.

**Appendices**

Supplementary material should be collected in an Appendix and placed before the Reference section.

**Acknowledgements**

Acknowledgements of people, grants, funds, etc. should be placed in a separate section before the References.

**References**

References to books, journal articles, articles in collections and conference or workshop proceedings, and technical reports should be listed at the end of article in alphabetical order. Articles in preparation or articles submitted for publication, unpublished observations, personal communications, etc. should not be included in the reference list but should only be mentioned in the article text (e.g. Moore, personal communication).

In the text, references should be cited in alphabetical order. A reference identified by means of an author's name should be followed by the date of the reference in parentheses. When there are more than two authors, only the first author's name should be mentioned, followed by 'et al.'. In the event that an author cited has had two or more works published during the same year, the reference, both in the text and in the reference list, should be identified by a lower case letter like 'a' and 'b' after the date to distinguish the work.

Examples:
Winograd (1986)
(Winograd, 1986a, b)
(Flores et al. 1988; Winograd, 1986)
(Bullen and Bennett, 1990)
Reference to books should include the author's name, year of publication, title, page numbers where appropriate, publisher, place of publication, in the order given in the example below.

Perera A K N Z and Wilfred K J 1991 Nitrogen Fixation in Tropical Cropping Systems. World International, Wallingford, Oxon, UK. 313 p.

References to articles in an edited collection should include the author's name, year of publication, article title, editor's name, title of collection, first and last page numbers, publisher, place of publication, in the order given in the example below.

Perera N K 1997 Iron requirement of cereals and legumes in solution culture. In Plant Nutrition-Physiology and Applications. Ed. M L Weerasekera. pp 113-117, Kluwer Academic Publishers, Dordrecht.

References to articles in conference proceedings should include the author's name, year of publication, article title, editor's name (if any); title of proceedings, first and last page numbers, place and date of conference, publisher and/or organization from which the proceedings can be obtained, place of publication, in the order given in the example below.

Wood G P 1969 Capillary conductivity data estimated by a simple method. In Water in the Unsaturated Zone. Vol. 1. Eds. P E Small and H Smith, pp 381-390. Proceedings of the Colombo symposium, June 1966, Colombo.

References to articles in periodicals should include the author's name, year of publication, article title, abbreviated title of periodical, volume number (issue number where appropriate), first and last page numbers, in the order given in the example below.

Tillman G L, Morrel E C and Osmond G 1984 Acidulation of Phosphate rock in soil. Soil Sci. Soc. Am. Proc. 28, 104-107.

References to technical reports or doctoral dissertations should include the author's name, year of publication, title or report or dissertation, institution, location of institution, in the order given in the example below.

Tyrone Y E 1995 Nitrogen nutrition of coconut trees. Ph.D. Thesis, University of Peradeniya, Peradeniya. 260 p.

PERMISSION

It is the responsibility of the author to obtain written permission for all quotations from any work in copyright, and for the reprinting of figures, tables or poems from unpublished or copyrighted material.