CORD Vol. XIX No. 1, 2003

FARMERS' PERCEPTIONS ON EXPANSION OF A NEW TECHNOLOGY: THE CASE OF COCONUT-BASED INTERCROPPING IN SRI LANKA

By

M.T.N. Fernando[a], M.E. Daw[b], and, I.E. Edwards[b]

ABSTRACT

Monocropping, the widely practiced traditional coconut cultivation system in Sri Lanka, utilizes bio-physical resources sub optimally, generating low returns to growers than its potential under an intensive cultivation alternative, coconut-based intercropping (CBI). Despite concerted efforts of successive governments, the adoption of CBI systems by farmers is low. This study investigates the farmers' perceptions of CBI on the premise that the understanding of farmers' perceptions of a new technology is important to identify the causes for the low adoption of that technology. Data were gathered by a field survey of 113 and 37 intercroppers and monocroppers respectively, in three main coconut-growing districts, namely Kurunegala, Gampaha and Puttalam, using a structured questionnaire supplemented with open-ended questions, through a single visit. Percentage analysis supplemented with a simple scoring device was employed to analyze the farmer's perceptions of CBI. Intercroppers objectives of intercropping, the constraints they face in expanding intercropping, reasons for non-adoption of CBI by present monocroppers and the suggestions of present intercroppers to further expand the CBI, all in the order of importance, are presented.

---

[a] *Coconut Research Institute, Lunuwila, Sri Lanka and* [b] *Dept. of Agriculture, University of Aberdeen, MacRobert Building, 581 King Street, Aberdeen, AB24 5UA, Scotland, UK.*

INTRODUCTION

Monocropping, the widely practiced traditional system of coconut growing in Sri Lanka, utilizes bio-physical resources such as soil/land, solar radiation etc. sub-optimally while generating low returns to growers than its potential under a more intensified cultivation system, coconut-based intercropping (CBI). Evidences for sub optimal biophysical resource use and generation of low returns by monocrop coconuts follow. As indicated by Reynolds (1995), a mature coconut palm in a pure coconut stand utilizes only 25 per cent of the soil mass, leaving some 75 per cent of the soil unutilized or under utilized. As Nair and Balakrishnan (1976) found, a mature coconut palm during a 6-hour peak brightest period of the day (i.e. 10.00 to 16.00 hours) intercepts effectively only about 44 per cent of the total solar radiation. As regards to economic considerations, CBI systems, namely: coconut + betel, coconut + pineapple + banana, coconut + betel + banana and coconut + pineapple generate respectively 11, 9, 8.7, and 5.7 times greater Net Present Values (at 20 per cent discount rate) than coconut monocrops (Fernando *et al.*, 1996). Of the national coconut area of 400,000 ha., some 100,000 ha. was found to be agronomically suitable for intercropping and integrazing. This suggests that there exists a greater scope to increase productivity of monocrop coconut lands by intercropping. Despite this scope and concerted efforts of successive governments over the years, the level of adoption of CBI systems by farmers is still as low as 25 000 ha, representing only a one fourth of the agronomically potential area. Understanding farmers` perceptions of a new technology, CBI in the case, is important to find out the causes for the low adoption of that technology. This understanding also provides insights into the constraints and potentials for the system improvement. On this premise, a study was conducted to analyze the farmers` perceptions of CBI with a view to providing insights into the low adoption of CBI. The specific objectives were to:

i) identify farming objectives of coconut-based inter-croppers;

ii) examine the adopters' perceptions of the constraints on intercropping;

iii) investigate the attitudes of monocroppers for non-adoption of CBI; and,

iv) to analyze the suggestions reported by present intercroppers to further expand the existing CBI systems

Conceptual Framework

Romero and Rehman (1989) lucidly established the conceptual differences among attributes, objectives and goals as follows:

"Attributes: Attributes can be defined as a decision-maker's values related to an objective phenomenon, and in a farm planning problem they include gross margin, profit, seasonal cash requirement, indebtedness.

Objectives: Directions of improvement of one or more of attributes are represented by the concept of objectives. Maximizing value added, minimizing risk, minimizing cost etc. are typical examples of objectives.

Goals: Before defining a goal, it is necessary to set a target, an aspiration level. A target is an acceptable level of achievement for an attribute. A goal is formed when an attribute is combined with a target. For instance, if a farmer wants a cropping pattern to yield a value added of at least some level (say Rs 2,000), it is called as a goal". (Although the objectives and goals are conceptually different, these words are used synonymously in this paper as it does not affect the purpose of the study).

Objectives have been classified into two main categories by Weerahewa (1991), namely objectives *"for farming"* and objectives *"in farming"*. The objectives, which lead farmers to be involved in farming, are called objectives *"for farming"* while objectives *"in farming"* refer to the objectives that farmers want to achieve once they are engaged in farming. This conceptual difference was taken into consideration to examine the two different categories of objectives of the present intercroppers. Although it is not easy to clearly distinguish the difference between them, an attempt was made to give them both due consideration.

METHODS

Data

Data were collected by a field survey of randomly selected 113 intercroppers and 37 monocroppers in three main coconut growing districts, namely Kurunegala, Gampaha and Puttalam using a structured questionnaire with open-ended questions. A single visit was made and a personal interview was conducted. However, 50 farmers from the main sample of 113 intercroppers were again selected randomly and interviewed using a one page supplementary questionnaire to articulate their farming objectives.

Analysis

Previous authors have used various approaches to identify farmers' objectives/goals as follows. Flinn *et al.* (1980) surveyed key respondent farmers in the Iloilo project of the Philippines to specify farmers' objectives. In addition, the findings of anthropologists and the views of institutional staff of the project have also been used for this purpose. Barnet *et al.* (1982) specified five goals by using the following procedures:

i) a farmer survey; ii) discussion with agricultural economists; iii) previous studies, and author's field observations. Weerahewa (1991) using a farmer survey specified two main goals of vegetable farmers in Sri Lanka. Keeney and Raiffa (1976), as cited by

Weerahewa (1991), summarized three approaches to elicit farmers objectives, i.e.

i) using a literature survey on objectives that various authors have used in similar studies;

ii) using an analytical model to test various objective functions to select the best-suited optimization criteria; and

iii) observing how farmers make decisions in relation to their farming.

Weerahewa (1991) supplemented the above summary by adding "elicitation of objectives of farmers by directly questioning them" as an approach to specify farmers objectives. This method was used for the present purpose.

Farmers were asked to rank their objectives/goals, which led them to be involved in intercropping, so-called *"goals for farming"*. The maximum number of objectives they identified were six, hence the ranks were from 1 to 6. The priorities of different farmers were different, and in consequence the ranks given to different objectives by different farmers were also different. This necessitates a scoring system to identify the objectives in order of priority. The objective ranked by farmers as the first was assigned a score of 6, while the 6th ranked objective was assigned a score of 1. Objectives ranked from second to fifth were assigned scores on a similar basis[1]. The same procedure was

adopted to identify: i) goals in farming, ii) constraints for intercropping, iii) reasons for non-adoption of CBI, and iv) suggestions to improve the prospects of inter-croppers, all in order of priority.

RESULTS AND DISCUSSION

1. Farming Objectives of Intercropping Farmers

Farmers' decision-making with regard to crop choice and resource allocation is predominantly influenced by their farming objectives. For this purpose, it is important to know the farming objectives of farmers.

1.1 Goals for farming

As shown by Table 1, the most fundamental goal for intercroppers to have involved in farming in general, and in intercropping in particular, is to generate a cash income[2].

---

[1] *We appreciate that a simple scoring system of this sort is imperfect because it assumes a continuous scale, i.e. it assumes that the importance of the 1st ranked goal is 6 times more important than the 6th ranked goal, which may not be the case. However, the purpose of devising this scoring system is to provide some idea to identify the goals in order of importance.*

[2] *It should be noted that farmers have diverse income-generating activities such as working off the farm as wage labourers, salaried occupations, non-farm activities such as rice mills, fibre mills etc., and farming is one among them, and also the traditional activity.*

Table 1. Intercroppers goals *"for farming"*

Goal	Sum of score
• To generate a cash income (to procure goods and services not produced in the farm)	285
• Securing food supply for the family	77
• Independent self-employment	68
• To cover the cost involved in raising coconut seedlings [a]	60
• To maximize land use	54
• To keep weeds controlled in the coconut land [b]	46
• To check soil erosion (by way of having a ground cover from intercrops)	31
• As subsidies were given, we have started to do intercropping	21
• As a hobby	10
• To protect coconut seedlings [c]	5
• As inherited the intercropping from the parents	4
Total	661

Notes:

a - Moisture conservation measures (through application of fibre dust), and fertilizer applied for intercrops greatly benefit the coconut seedlings which results in reducing the cost of raising of coconut seedlings.

b - When coconut lands are intercropped, the inter-spaces of coconuts are covered by intercrops which prevents the excessive growth of weeds in the inter-spaces.

c - When coconut lands are intercropped they are usually fenced particularly to avoid the access to wandering cattle. Coconut seedlings are also thus benefited in terms of protection.

Source: Farmer survey, 1995.

This finding is consistent with empirical results of Herath's (1982) study with regard to rice farmers in Sri Lanka, which suggests that the main goal of farming is to generate a cash income by producing a marketable surplus. This objective, however, varies from income generation to wealth accumulation, depending on the farmer categories. That is to say that the higher-income groups of farmers may use farming to generate more and more cash, thus accumulating wealth while the expectation of low-income groups of farmers is merely to generate a cash income only to buy goods and services not produced in the farm. Table 1 further shows that securing family food requirement is the second major concern of being involved in farming. However, this finding looks contradictory because a greater percentage of most of the intercrops produced in the farm is often sold, and only about 2% are retained for household consumption, but the validity of this finding can be substantiated in the light of the following reasoning. Traditionally, the farming units in the surveyed area were characterized by highland coconut land/s and lowland rice land/s, intercropping being practiced on the highland coconut land. This means that the intercroppers of the survey are also rice growers. Rice cultivation is mainly for household consumption though whatever left is sold. Hence the objective of farming, in particular rice farming, is to meet household consumption requirements. It follows that the ranking of securing of family food requirement as the second most important objective is quite reasonable. The order of priority of other objectives is as shown by Table 1.

1.2 Goals in farming

Although the conceptual difference between *"goals in farming"* and *"for farming"* is quite clear in definition, precise elicitation of them is not always an easy task. The art of presenting the question to farmers is important, and a fair amount of field experience and intuitive judgment of the researcher is required on top of farmers' answers to find out the goals *"in farming"*. The following goals *"in farming"* have been identified (Table 2), by taking all the above considerations into account. The objectives *"in farming"* are basically concerned with how farmers allocate their resources and choose crops to achieve their goals once they are involved in farming. As shown in Table 2, they choose crops and allocate resources in such a way that it maximizes the profits; minimizes the labor hiring; increases the leisure; minimizes the yield and price risk; spends less on paid inputs; minimizes the borrowing of capital etc.

Tabel 2 Goals "*in farming*"

Goal:	Score:
• Maximizing profit	243
• Minimizing labour hiring	68
• Increasing leisure	62
• Avoiding yield and price risk	59
• Spend less on inputs	38
• Minimizing borrowing capital	26
• Selecting crops conventional to the area	9
• Not to allow idle fertile soil resource	8
• To improve young coconut palms growth	7
• Growing a crop easy to protect against theft	6
• Growing a crop which is capable of giving an income within a year	4
• Growing a crop to suit the shade cast by the existing coconut canopy	4
• Growing a crop capable of giving an income within 14 days	3
• Growing a crop that can be sold easily	2

Source: Farmer survey, 1995.

Results of both objectives *"for farming"* and, objectives *"in farming"* substantiate that the farming objectives of present intercroppers is to maximize the profit while securing family food requirement.

2. Adopters perceptions of the constraints on intercropping

Perceptions of present intercroppers of the constraints on intercropping, suggestions made by them to improve their prospects, and non-adopters' reasons for not adopting the intercropping systems were collected from the survey. These three major pieces of information are analyzed in turn in this section and the results are presented.

2.1. Analysis of constraints for intercropping

The present intercroppers have identified 21 constraints for intercropping and these constraints were analyzed using a scoring system. The relative importance of constraints was ranked assigning scores ranging from 1 to 7 (the maximum number of ranks reported). The constraints ranked by farmers as being first were assigned 7, while the seventh ranked constraints were assigned 1, and the other constraints ranked between 1 and 7 were assigned scores correspondingly. The total score with respect to each constraint was calculated. The sum of these total scores was computed as 2,141 and this was divided by the number of constraints to calculate the mean score (102 points) per constraint. Constraints having scores over and above the mean score were categorized as important constraints requiring immediate attention. This does not however mean that all the other constrains whose total score is less that the mean score are unimportant. Rather, the idea of the "mean score device" is to provide an objective base to highlight the most important constraints. Total scores against each constraint are shown in Table 3.

The single most important constraint to intercropping, as indicated by present intercroppers, is associated with the price aspects of the intercrops. Farmers could not precisely define this constraint, though they variously explained it as: "low prices for intercrops", "cannot receive a fair price for intercrops", "collectors always bargain for low prices", "fluctuations and uncertainties of intercrop prices", etc.

The second most significant reported constraint is the high prices of inputs, more importantly the inorganic fertilizer and agro-chemicals. The subsidy on inorganic fertilizer which was commenced in 1962 primarily for rice was extended in 1972 to a range of other crops and this was implemented through direct payment to importers (Abeysinghe, 1990). This subsidy has been "on" and "off" over the years; the government withdrew it on 31 December 1989 and then reinstated it October 1994 in effect only for 65 days, after which it was again removed. Farmers view the removal of the subsidy on fertilizer as an important constraint.

Drought, pest and disease, scarcity of hired labor and lack of cash are the other important constraints in order of significance.

Table 3. Constraints indicated by farmers and their total scores

No.	Constraint	Total score
1	Low price for produce, price fluctuations and price uncertainty etc.	375
2	High price of inputs (fertilizer, agro-chemicals etc.)	365
3	Drought	342
4	Pest and disease problems	262
5	Scarcity of hired labor	216
6	Lack of cash	121
7	Lack of extension support/lack of knowledge	95
8	Scarcity of fibre dust	65
9	Theft	48
10	marketing problems (collectors do not come in glut periods)	40
11	Scarcity of own lands	40
12	Lack of credit facilities	39
13	Lack of family labor	29
14	Damage from monkeys/porcupines/cattle	26
15	Leased lands are not available	22
16	Non-availability of planting materials	19
17	High price of fibre dust	17
18	Difficulties in transporting stakes (e.g. for betel)	7
19	Scarcity of stakes (e.g. for betel)	5
20	Adulterated fertilizer	4
21	No place for agriculture	4
	Sum of total scores	2,141
	Mean score (rounded)	102

Source: Farmer survey, 1995

The drought problem reported by farmers raises one fundamental question with regard to the identification of agronomically suitable areas for intercropping. This survey was conducted in areas, which were demarcated as agronomically suitable areas for intercropping. For this demarcation, the agronomic suitability was more broadly defined in terms of soil and rainfall considerations. However, during the survey it was perceived that the poor distribution of rainfall even in these originally conceived suitable areas is a problem of significant practical relevance for certain intercrops such as betel. This raises a doubt whether the agronomically suitable areas for intercropping classified decades ago still exist with the consistently decreasing trend of rainfall in most of the coconut-growing areas in the country. On the other hand, the legitimacy of the farmers' claim of a drought problem has to be judged because it was observed during the survey that when one farmer says drought is a severe problem for him the adjoining neighboring farmer appears to have minimized the drought effect by means of appropriate moisture conservation measures. This observation relates to the identification of agronomic research priorities concerning the drought problem. Research on developing efficient moisture conservation measures might be prioritized as an area requiring immediate concern while keeping research on developing drought-resistant varieties as a long-term strategy.

This analysis also suggests that disease problems are a significant constraint which intercroppers experienced. The most important diseases are bunchy top and panama in banana, wilt in pineapple, and soft rot in ginger.

Table 4. Annual labor requirements (in man days per acre) of different crops

Crop	Year 1	Year 2	Year 3	Year 4	Year 5	Average of five years [c]
Monocrop coconut [a]	11	11	11	11	11	11
Ginger [b]	119					119
Banana	41	19	16	19	28	24.6
Pineapple	78	42	46	29	24	43.8
Betel	191	151	150	165	161	163.6

Notes:
a - labor requirement of a mature coconut stand.
b - ginger is an annual crop.
c - Sum of labor requirements over the five years was divided by the number of years (5) to derive the annual average labor requirement.

Source:: Farmer survey, 1995.

Scarcity of hired labor is an another important problem identified by the farmers. One of the government objectives with regard to popularizing intercropping in coconut lands is to generate increased employment. Table.4 summarizes annual labor requirements of different crops.

Annual average labor requirements for banana, pineapple, ginger and betel are about 2, 4, 11 and 17 times greater, respectively, than that of coconut monoculture. This clearly establishes that growing intercrops with coconut associations has a greater employment potential.

On the other hand, present intercroppers claim that hired labor to employ in intercropping is seriously lacking. This scarcity of hired agricultural labor in rural areas is not due to the fact that the rural labor force is already fully employed. The implication is that although rural unemployment still persists, the new generations, which take over the active labor force in the country rarely like to be employed as agricultural labourers. Instead, they prefer to work as industrial labourers, even for lower wages. Therefore, the success of generating of employment by intercropping as a solution to the problem of rural unemployment is questionable.

If the outcome of the "mean score device" is taken literally, the lack of extension support was considered as a less important[3] constraint. However, the field experience gained during the survey suggested that the extension service has an important role to play in popularizing the intercropping among present non-adopters (increasing the *incidence of adoption*[4]), and to expand the intercropping of the present adopters (increasing the *intensity of adoption*[5]); hence its importance cannot be overlooked.

The scarcity of fibre dust, theft of intercrops, lack of collectors during glut periods, scarcity of owned land, lack of credit facilities and of family labor are also important constraints limiting the expansion of CBI.

2.2. Analysis of reasons reported by present monocroppers for non-adoption of CBI

A scoring system, as in previous sections, was employed to identify the relative importance of reasons reported by monocroppers for non-adoption of CBI. Scores ranged from 1 to 5, because the maximum number of ranks reported by farmers were 5.

Non-adapters reported 11 reasons, which prevent them being involved in intercropping. The relative total scores with respect to each reason are shown in Table 5. The most

[3] Note that we are careful to avoid using the word "unimportant".

[4] *Incidence* refers to the probability of adoption of CBI at individual farm level, where the adoption is represented in dichotomous terms, i.e. adoption/non-adoption.

[5] *Intensity* refers to the degree or extent of adoption of CBI in a given individual farm, i.e. the proportion of land brought under CBI.

important two reasons, which prevent monocroppers from adopting intercropping, are lack of cash and lack of time/family labor. This indicates that the most important constraints, Drought, scarcity of hired labor, poor extension support are the other important reasons, in the order of priority, which affect intercropping decision.

Table 5. Relative importance of different reasons measured in terms of total scores

No.	Reason	Total score
1	Lack of cash	74
2	Lack of time/family labor	70
3	Drought	63
4	Scarcity of hired labor	53
5	Lack of extension support/lack of technical knowledge	50
6	High price of inputs	27
7	Low price for produce	27
8	Theft	8
9	Non-availability of planting materials	6
10	Have other better income sources	5
11	Delay in subsidy payments	3
	Sum of total scores	386
	Mean score (rounded)	35.1

which present inter-croppers experience while they are in the intercropping business and the most important reasons, which keep the present monocroppers out of the intercropping business, are different. For example, major constraints for present intercroppers are associated with price aspects of produce and inputs, while they are lack of cash and lack of time with regard to present monocroppers. This suggests that the approaches to be taken to motivate new farmers to take up the CBI, and to keep the present intercroppers in the CBI business, have to be different.

2.3 Analysis of suggestions reported by present intercroppers to improve the prospects of intercroppers

Views with respect to improving the prospects of intercroppers were collected only from the present intercroppers. A similar scoring system, as in the previous two cases, was adopted to rank the significance of suggestions. The maximum number of ranks indicated by farmers were 7, and, in total, 21 suggestions were proposed. Accordingly, the maximum score in the scoring scale is 7, while the minimum was 1. Total scores with

respect to each suggestion was calculated (Table 6).

Providing fertilizer at a low price was the suggestion, which received the highest score. These suggestions are consistent with the previously discussed important constraints identified by intercroppers. The bulk of the inorganic fertilizers are imported into Sri Lanka and supplied to farmers at a subsidized low price at state expense. This subsidy has been "on" and "off", and the method of payment has also been changed from time to time. The farmers' view is that the local market price of fertilizer is too high. Although subsidizing fertilizer price may increase the producer's profit margin, it is at a cost

Table 6. Relative significance of suggestions reported by intercroppers to improve the prospects of intercroppers

No.	Suggestions	Total score
1	Reduce the fertilizer price/provide fertilizer at a subsidized price	478
2	Provide a reasonable price for the produce/provide direct selling Facilities without middlemen/control price	363
3	Provide technical advice	242
4	Financial assistance (subsidies)/low interest loans	163
5	Provision of agricultural implements at a subsidized price (water Pumps, 2 wheel tractors, 4 wheel tractors)	89
6	Provide pesticides, weedicides etc. at a subsidized price	89
7	State assistance for supplement irrigation (e.g. assistance for Agricultural wells)	75
8	Solution for scarcity of hired labor (e.g. look for means of mechanization)	42
9	Disease free planting materials	30
10	Solution for the scarcity of fibre dust	24
11	Make available leased lands (e.g. permit to grow on crown lands On a leased agreement)	24
12	Improve export facilities	23
13	Measures to stop adulterated fertilizer	11
14	Improve the crop insurance scheme	7
15	Make available disease control measures	7
16	Introduction of improved methods of weed control	5
17	Introduction of improved varieties of intercrops	5
18	Introduction of an alternative mulching material instead of fibre dust	5
19	Intervention of officials to remove infected intercrop cultivation in Farmers fields as a measure of preventing disease spread	5
20	Creation of large scale commercial nurseries	5
21	Support to prevent the damages by mammals (e.g. providing a Gun to kill monkeys)	4
	Total score	1,696
	Average score (rounded)	81

Source: Farmer survey, 1995.

to the country. This aspect needs further investigation to find out the optimal trade-off between producer margins and government expenditure on fertilizer subsidies.

The second most important suggestion (perhaps equally important) was that of the ensuring a reasonable price for the produce of the intercroppers. Although presently free market forces determine the market prices of these products, the involvement of middlemen may manipulate their farm-gate prices. This aspect also requires further investigation to identify whether an unfair share is enjoyed by the middlemen.

Obviously, one should expect consistency between these two of the most important suggestions and the previously discussed important constraints identified by intercroppers. The results suggest that there is a congruence between suggestions and constraints, but in the reverse order, meaning that the most important and the second most important constraints were low prices for intercrops and high prices of inputs (inorganic fertilizer) respectively, while the suggestions for the expansion of intercropping were the same but their relative importance was in reverse order. Explanations are not necessary for this inconsistency because one should not expect complete precision in answers from farmers for almost similar questions asked differently.

Ensuring a reasonable price to producers could be achieved through government intervention by means of introducing a floor price, but this also entails a cost to the government in instances where the farm-gate price goes below the floor price. Consequently, this consideration also needs further study to find out the trade-off between government cost and producers' welfare.

The broadening of export opportunities, coupled with greater efficiencies in marketing channels (i.e. without allowing middlemen to enjoy an unreasonable share of high prices), could potentially bring about higher prices to the producers.

The other important suggestion is to strengthen the technical advice to present intercroppers. The importance of technical advice has recently been more marked with the a) recent widespread occurrence of panama disease in banana, and b) persistence of wilt disease in pineapple.

Feder *et al.* (1982), in their comprehensive survey of various studies concerning adoption patterns of agricultural innovations, commented on the conventional wisdom of constraints to the rapid adoption of innovations. They write: "such factors as lack of credit, limited access to information, aversion to risk, inadequate farm size, inadequate incentives with regard to tenure arrangements, insufficient human capital, absence of equipment to relieve labor shortages, weakness in supply of complementary inputs and inappropriate transport facilities etc. constrain the rapid adoption of innovations". This study supports the above comment, and perhaps it may be

added that the low prices for produce and high prices of inputs also limit the rapid adoption of innovations.

SUMMARY AND CONCLUSIONS

In view of the sub optimal use of biophysical resources and low returns to growers generated by monocrop coconuts, coconut-based intercropping (CBI) was identified as an alternative technology, which uses those resources efficiently while generating higher returns to growers. However, the adoption of this new technology is still low despite heavy government efforts over the last two decades. A study was carried out to assess the farmers' perceptions on expansion of this new technology. The data were collected by a field survey of 113 intercroppers and 37 monocroppers in three main coconut growing districts in Sri Lanka, namely Kurunegala, Gampaha and Puttalam. Simple percentage analysis together with a simple scoring system was employed to identify the farmers perceptions in order of relatively importance. The following conclusions were drawn.

- Farmers' prime objective 'for farming' was to generate a cash income. This varied from income generating to wealth accumulation, depending on the farmer category. Other objectives which led them to be involved in intercropping were to: secure a food supply for the family, provide independent self-employment, to cover the costs involved in raising coconut seedlings, to maximize use of the land, etc.
- The major constraints for CBI in order of priority, as highlighted by present adopters, were the uncertain and low price of intercrops, and high prices of inputs, particularly
- The inorganic fertilizer and agro-chemicals. Drought, disease problems, scarcity of hired labor, and a lack of extension support were other important constraints.
- The main reasons for the non-adoption of CBI by the present monocroppers were (in order of priority): shortages of cash, shortages of family labor/time, drought problems, scarcity of hired labor, lack of knowledge, high prices of inputs, and low prices for produce.
- The major suggestions of the present intercroppers to improve prospects were consistent with the constraints above, although not necessarily in the same order. They were, in order of priority: providing fertilizer at a subsidized rate, ensuring a reasonable price for intercrops, providing technical advice, providing financial assistance (subsidies and low interest loans), and provision of agricultural equipment at a subsidized price.

Acknowledgments: This study forms a part of a Research Project (Grant No. 12/201/174) funded by the Council for Agricultural Research policy (CARP) of Sri Lanka. Authors are grateful to Dr.R. Mahindapala, Dr. D. Kirtisinghe, respectively Former Executive Director and Executive Director of CARP for their co-operation and the Acting Director, Coconut Research Institute of Sri Lanka for providing permission to publish this paper.

The early work of Professor P. Abeygunawardena, former Head, Department of Agricultural Economics, Faculty of Agriculture, University of Peradeniya, in preparing the research proposal is gratefully acknowledged. Thanks are also due to Messrs. N. S. Jayalath, S. D. J. N. Subasinghe, R. P. S. Nishantha, P. H. A. Wijetunge, B. N. Priyajanake, D. Ranaweera, H. M. G. A. Herath and R. L. Hapuarachchi for their assistance in conducting the survey, and Mrs. K.V.N.N. Jayalath for typing the manuscript.

REFERENCES

Abeysinghe, A. (1990). Fertilizer subsidy and rice imports. *Economic Review*, **15(11)**, 18-21.

Feder, G., Just, R. E. and Zilberman, D.(1982). *Adoption of agricultural innovation in developing countries: A survey*. World Bank Staff Working Papers, No. 542, The World Bank, Washington, D. C., USA.

Fernando, N., Edwards, I. and Daw, M. (1996). Coconut-based intercropping systems in Sri Lanka. *Proceedings of Aberdeen University Agriculture Graduates Association*, 8, 34-35.

Flinn, J. C., Jayasuriya, S. and Knight, C. G. (1980). Incorporating multiple objectives in planning models of low-resource farmers. *Australian Journal of Agricultural Economics*, **24**, 35-45.

Herath, H. M. G., Hardaker, J. B., and Anderson, J. R. (1982). Choice of varieties by Sri Lankan rice farmers: Comparing alternative decision models. *American Journal of Agricultural Economics*, **64**, 87-93.

Keeney, R. L. and Raiffa, H. (1976). *Decision with Multiple Objectives. Preference and Value Trade Off.* New York: John Wiley & Sons.

Nair, P. K. R. and Balakrishnan, T. K. (1976). Pattern of light utilization by canopies in a coconut/cocoa crop combination. *Indian Journal of Agricultural Science*, **46**, 453-462.

Reynolds, S. G. (1995). *Pasture-Cattle-Coconut Systems*. Food and Agriculture Organization of the United Nations, Regional Office for Asia and the Pacific (RAPA), RAPA Publication 1995/7, Bangkok, Thailand.

Romero, C. and Rehman, T. (1989). *Multiple Criteria Analysis for Agricultural Decisions*. Elsevier.

Weerahewa, H. L. J. (1991). *An empirical test of multiple objective vs. single objective decision making in farming systems at Hanguranketa and Walapane areas: Nuwara Eliya district.* Unpublished MPhil thesis, PGIA, University of Peradeniya, Sri Lanka.