Journal of Agricultural Science and Food Research

Ruvani Subhathma, J Agri Sci Food Res 2018, 9:3

Research Article Open Access

Analysis of Adoption Levels of Technologies Recommended for the Management of Major Coconut Pests in Sri Lanka

Ruvani Subhathma WG*

Technology Transfer Officer, Coconut Research Institute, Sri Lanka

***Corresponding author:** Ruvani Subhathma WG, Technology Transfer Officer, Coconut Research Institute, Sri Lanka, Tel: +94312255300; E-mail: ruvanigodage@gmail.com

Rec date: June 12, 2018; **Acc date:** June 21, 2018; **Pub date:** June 30, 2018

Abstract

Coconut production in Sri Lanka is threatened by pest and diseases. Therefore, different remedial measures have been introduced by Coconut Research Institute (CRI) to safeguard the plantations. This study was carried out to determine the level of technology adoption to manage major coconut pests by the coconut farmers in different land categories. The farmers were selected from the Kurunegala district, which is the major coconut growing district in coconut triangle in Sri Lanka. Findings of the study revealed that more than 70 percent of the growers in all land categories above 2Ac had adopted technologies recommended by CRI to control black beetle. Technology adoption level was around 60 percent for red weevil control, nearly 30 percent for coconut mite and around 65 percent for plesispa beetle. Farmers' perceptions affect their technology adoption decisions. There are two factors that possibly affect the farmers' perception namely; information receiving sources and occurrence of a pest attack in their fields. Since the farmers are having limited resources to get essential information on coconut cultivation, they were unable to find recommended technologies to control all these four pests. In addition, the study revealed that unawareness of technologies and low attention for coconut farming were the two major reasons for poor adoption levels of the recommended technologies. It can be concluded that coconut growers in Kurunegala district require more awareness regarding recommended technologies to manage major coconut pests. For that purpose, farmer level extension programs should be strengthened.

Keywords: Technology adoption; Pest; Coconut; Farmer perceptions; Coconut growers; Recommended technologies

Introduction

Coconut (*Cocos nucifera* L.) is one of the most widely grown plantation crop in the tropics. It spreads over 400,000 ha of land area in all administrative districts of Sri Lanka except those at the elevations beyond 750 m above mean sea level [1,2]. The annual nut production was 3056 million in 2015 [1]. Coconut is considered as a crop of multipurpose use providing food, shelter, oil, medicine, fuel, building materials and beverage. Therefore, coconut is interwoven with the lives of local people and considered as a "Tree of heaven" or the "Tree of life". Coconut industry generates employment for nearly 500,000 people and contributing to nearly 0.7 percent of gross domestic production and 1.0% of foreign exchange earnings [1,3]. Coconut is an important source of dietary energy for Sri Lankans as well as other people all over the globe. The coconut endosperm (kernel) based products are essential components in Sri Lankan diet which provides about 22 percent per capita calorie requirement. Consequently, about 70 percent of the annual coconut production is used for local consumption leaving nearly 30 percent for the coconut-based industries. Coconut is highly concentrated in the coconut triangle comprising the districts of Kurunegala, Gampaha and Puttalum covering about 75% of the coconut growing lands in the country [2]. Coconut occupies more than 12,000ha in Galle, 14,000ha in Matara and 20,000ha in Hambantota districts in the Southern province forming a "mini coconut triangle" [4].

The coconut sector in Sri Lanka shows a commendable growth during recent past years. However, steady economic growth of this sector is affected by many factors such as fragmentation of coconut lands, unfavorable weather conditions and attacks by pests and diseases. Introduction of serious pests and diseases aggravates this situation. For example, introduction of coconut mite, *Aceria guerreronis* Keifer into Sri Lanka in late 1997 was considered a major threat to the coconut production [5] and an annual national crop loss of about 2% was estimated [6]. Similarly, Weligama Leaf Wilt disease that is spread in over 40,000ha in the Southern province is the most serious threat to coconut industry in the recent past. In addition, red weevil (*Rhynchophorus ferrugineus* Olivier), Black beetle (*Oryctes rhinoceros* L.), Plesispa beetle (*Plesispa reichi*) and coconut caterpillar (*Opisina arenosella* Walk) are considered as major pests in coconuts [7]. CRI has already introduced proven technologies to control these pest damages in farmer fields. However, the problem is continuing, and many coconut growers are not aware of the remedial measures and may reluctant to adopt those measures due to uncertainty of the results. Therefore, this study aimed to identify the factors affecting the adoption levels of technologies recommended for the management of major coconut pests in farmer fields.

Objectives

Main Objective: To identify the factors affecting the level of technology adoption among coconut farmers.

Specific Objective: To measure the level of technology adoption by farmers.

Materials and Methods

Study area and sampling method

This study was conducted using sociological survey method and farmer fields were selected from Kurunegala district, which is one of the major districts in the coconut triangle of Sri Lanka. Stratified simple random sampling method was applied to collect data. The sample size was determined using optimal allocation according to total holding size in each land category. The sample size for each land category was as below mentioned (Table 1).

Land Categories	Sample Size
<2 Ac	35
2-5 Ac	50
5-20 Ac	20
>20 Ac	12

Table 1: Distribution of sampling units among land categories.

Data collection

Data collection was carried out using direct structured and open-ended questionnaire. Relevant information was collected through face to face interviews with growers after visiting the randomly selected sites. The questions were derived from the technologies recommended by the Coconut Research Institute (CRI). The questions were derived to get information regarding most influential factors for adoption of recommended technologies by the coconut Research Institute to control major coconut pests such as black beetle, red weevil, coconut mite and plesispa beetle.

Results and Discussion

Demographic characteristics of the respondents

Decision making of farmers is influenced by demographic factors [8]. Those are age, education level and gender. The demographic characters of coconut growers in selected sample in Kurunegala district is shown (Tables 2 and 3).

Farmer characteristics	Farm size categories				All
	<2 Ac	2-5 Ac	5-20 Ac	>20 Ac	
Age (years)*	53.52	55.24	59	54	55.2
SD	-11.03	-8.51	-11.24	-13.32	-10.3
Education Level	1	2	2	2	2
	-1.49	-2.22	-1.8	-2.33	-1.94
% Sex ratio (M/F)	60%	82%	80%	83.33% (10/12)	75.21% (88/117)
	(21/35)	(41/50)	(16/20)		

Table 2: Demographic characteristics of the selected sample of growers according to land size.

	Education Level			
	Primary (O/L)	Secondary (A/L)	Diploma	Degree
Ranking	1	2	3	4

Table 3: Ranking procedure to determine the educational level of the coconut grower.

The average age of growers in Kurunegala district was 55.2 years. Most of the coconut growers in Kurunegala district have secondary level (passed the G.C.E. (A/L)) educational background. Most of the growers were male.

Comparison on application of recommended technologies

Average percentage of recommended technologies applied by the growers to control four different pest species in different land categories are shown in Table 4.

Land size categories	<2 Ac				2.5 Ac				5-20 Ac				>20 Ac			
Pest Species	BB %	RW %	Mite %	Plesi. %	BB %	RW %	Mite %	Plesi. %	BB %	RW %	Mite %	Plesi. %	BB %	RW %	Mite %	Plesi. %
Recommendation applied	65(13)	31.58(6)	13.33(4)	16.67(2)	73.17(30)	64.29(27)	42.11(16)	76.19(16)	93(13)	61.11(11)	31.25(5)	63.64(7)	81.82(9)	58.33(7)	33.33(3)	66.67(6)
Recommendation not applied	35(7)	68.42(13)	86.67(26)	83.33(10)	26.83(11)	35.71(15)	57.89(22)	23.81(5)	7(1)	38.89(7)	68.75(11)	36.36(4)	18.18(2)	41.67(5)	66.67(6)	33.33(3)

Table 4: Percentage application of recommended technologies according to farm size. *The figures in parenthesis are in number.

According to the Table 4, more than 70 percent of the growers in all land categories above 2 Ac are applied the recommended technologies introduced by the CRI to control black beetle pest. Application of recommended technologies for control red weevil pest is around 60 percent; for control coconut mite pest, it is around 30 percent and for control plesispa beetle, it is around 65 percent. In <2 Ac land category, the application of recommended technologies for control four major pests is very poor.

In coconut sector, management system currently being practiced for control pest problem is "Integrated Pest Management method" [9]. This method is highly effective and economically feasible for growers.

Extent of technology adoption in different land categories to manage black beetle pest is shown in Table 5 and Figure 1.

No.	Recommendation	Method	Extent of Adoption (%)			
			<2 Ac	2-5 Ac	5-20 Ac	>20 Ac
1	Coal tar/Pass engine oil	Prevention	55	63	64	55
2	Field sanitation/ Naphthalene balls	Prevention	35	34	50	27
3	Metal hook	Control	10	5	0	9
4	Carbofuran	Control	40	51	21	64
5	Metarrhizium fungus	Control	0	0	0	0
6	Pheromone trap	Control	0	0	14	0
7	None	None	30	27	29	18

Table 5: Extent of technology adoption in different land categories to manage black beetle pest.

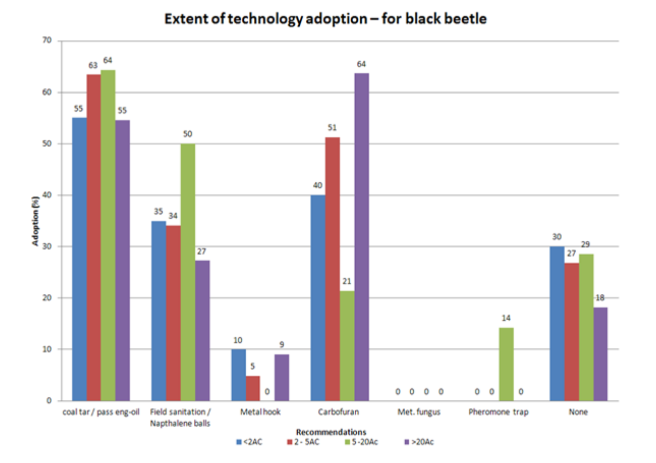

Figure 1: Extent of technology adoption in different land categories to manage black beetle pest.

Farmers in all land categories, mostly adopted management method for control black beetle is "application of coal tar or used engine oil on leaf axils around the bud region". It is more than 55%. The next highly adoption methods are "placing naphthalene balls into each of the innermost leaf axils and maintaining better field sanitation conditions" respectively. All these management practices are considered as preventive measures for black beetle pest problem (Figure 1). When considering the control methods, most of the farmers in all land categories are mostly adopted for "application of carbofuran granules" to kill beetles, in addition to "use of pointed metal hook to remove beetles". However, the practice of pheromone trap is very poor.

Extent of technology adoption in different land categories to manage red weevil pest problem is shown in Table 6 and Figure 2.

No.	Recommendation	Method	Extent of Adoption (%)			
			<2 Ac	2-5 Ac	5-20 Ac	>20 Ac
1	Use of Penthoate chemical	Control	11	24	33	17
2	Use of Monocrotophos chemical	Control	11	10	17	17
3	Routine examine	Prevention	5	21	44	25
4	Coal tar/ Pass engine oil	Prevention	32	55	28	25
5	Field sanitation	Prevention	5	5	17	17
6	Use of pheromone trap	Control	0	5	11	25
7	None	None	68	33	33	42

Table 6: Extent of technology adoption in different land categories to manage red weevil pest.

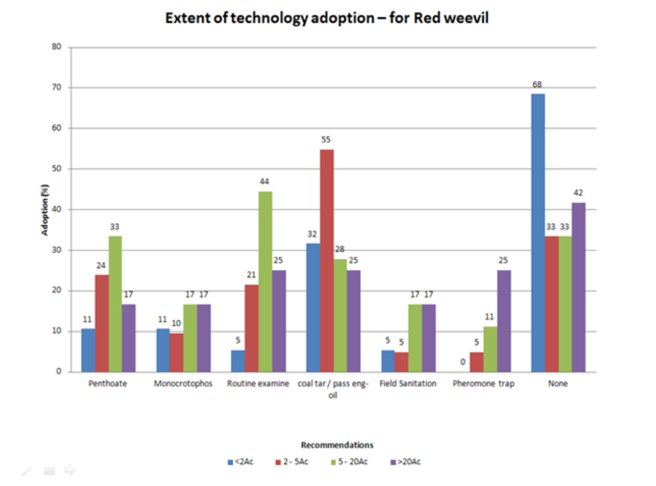

Figure 2: Extent of technology adoption in different land categories to manage red weevil pest.

A glance at the Table 4 reveals that 55 percent farmers in 2-5 Ac land category have adopted to "apply coal tar or passed engine oil on freshly making wounds on trunks and petioles of all young palms" as preventive method. Although 33% farmers in 5-20 Ac land category are adopted for "apply Penthoate 500 EC chemical injection method". 17% farmers in 5-20 Ac and >20 Ac land categories are adopted to use monocrotophos chemical injection method (Figure 2). It is revealed from the Table 4 that only 25 percent farmers in >20 Ac land category have adopted to use pheromone traps to control red weevil attack and followed by 11% and 5% in 5-20 Ac and 2-5 Ac land categories respectively. It is clear from the Table 4 that more than 33% farmers in all land categories have not adopted the technologies developed by the CRI. Extent of technology adoption in different land categories to manage coconut mite pest problem is shown in Table 7 and Figure 3.

No.	Recommendation	Method	Extent of Adoption (%)

			<2 Ac	2-5 Ac	5-20 Ac	>20 Ac
1	Remove and burn infested inflorescence	Control	10	8	0	0
2	Use of Furnace oil	Control	7	8	6	0
3	Use of palm oil/Sulfur mixture	Control	3	29	13	33
4	Application of predator mite	Control	0	16	6	22
5	None	None	63	55	75	56

Table 7: Extent of technology adoption in different land categories to manage coconut mite pest.

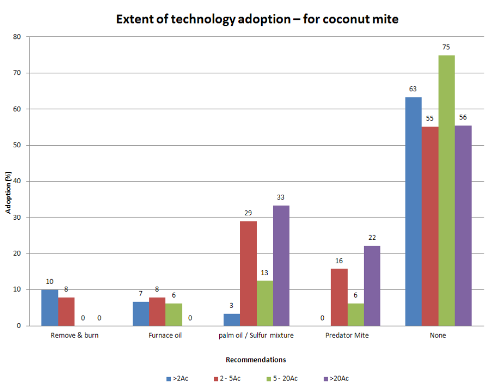

Figure 3: Extent of technology adoption in different land categories to manage coconut mite pest.

It is observed from the Table 5 that 33 percent and 22 percent farmers in >20 Ac land category have adopted to apply palm oil/sulfur mixture and predator mite respectively. However, more than 55 percent farmers in all land categories have not adopted any of the technologies introduced by the CRI to manage coconut mite in their farmer fields (Figure 3). Extent of technology adoption in different land categories to manage plesispa beetle pest problem is shown in Table 8 and Figure 4.

No.	Recommendation	Method	Extent of Adoption (%)			
			<2 Ac	2-5 Ac	5-20 Ac	>20 Ac
1	Carbosulfan/Chloropyrifos/ Marshal 20	Control	17	76	64	67
2	None	None	58	24	45	22

Table 8: Extent of technology adoption in different land categories to manage plesispa beetle pest.

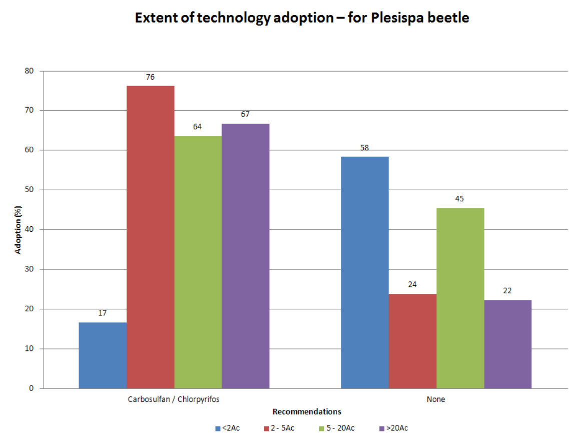

Figure 4: Extent of technology adoption in different land categories to manage plesispa beetle pest.

Table 6 indicates that majority of the farmers (more than 60%) in all land categories except <2 Ac category have adopted the recommended technology to control plesispa beetle (Figure 4).

	Recommendation applied/not	Information received	Damage occurrence
For Black beetle			
Pearson correlation	1	0.366**	0.520**
Sig. (2-tailed)		0	0
N	117	117	117
For Red Weevil			
Pearson correlation	1	0.314**	0.699**
Sig. (2-tailed)		0.001	0
N	117	117	117
For Coconut Mite			
Pearson correlation	1	0.054	0.661**
Sig. (2-tailed)		0.567	0
N	117	117	117
For Plesispa Beetle			
Pearson correlation	1	0.290**	0.868**
Sig. (2-tailed)		0.001	0

N	117	117	117

Table 9: Perceived factors in adoption of technologies by farmers. **Correlation is significant at the 0.001 level (2-tailed).

It is revealed from the Table 9 that persistent of damaged palms in farmer fields and information receiving to farmers regarding CRI recommended technologies are significantly affect to perception of adopting technologies (Table 10).

No.	Perceived constraints	Black beetle %	Red Weevil %	Coconut mite %	Plesispa beetle %
1	Unawareness of technologies	22.99	28.99	39.8	24.6
2	Low attention for coconut farming	26.44	41.11	58.16	31.15
3	Poor economic status	2.3	Not indicated	6.12	Not indicated
4	Shortage of chemicals	Not indicated	36.67	Not indicated	Not indicated

Table 10: Perceived constraints to non-adoptability of recommended technologies.

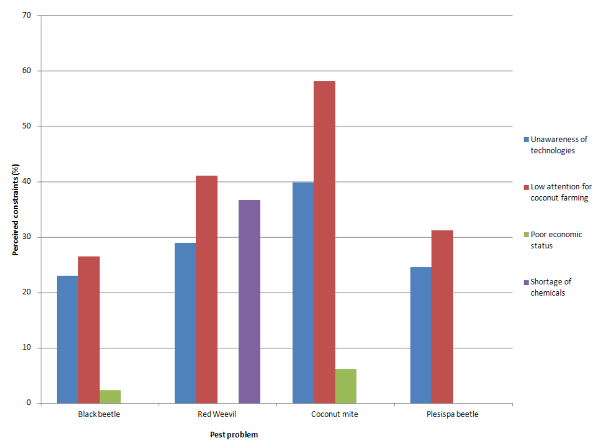

Figure 5: Perceived constraints to non-adoptability of recommended technologies.

The data in respect of perceived constraints indicated in Table 8 reveals that unawareness of technologies and low attention for coconut farming are the two major reasons for non-adoption of recommended technologies (Figure 5).

Conclusion

The findings of the study revealed that more than 70 percent of the growers in all land categories except <2 Ac land category have adopted technologies recommended by the CRI to control black beetle pest. Technology adoption for control red weevil is around 60 percent, for coconut mite it is around 30 percent and for plesispa beetle it is around 65 percent. The data presented in the paper also reveals that more than 55 percent farmers in all land categories have not adopted any of the technologies introduced by the CRI to manage coconut mite in their farmer fields. This is because of farmers are not much aware of the spraying of palm oil/sulfur mixture and their inability of buying predatory mite bags. Reason behind the technology adoption by farmers is mainly the farmers' perception. As a result, during this study two factors were found affecting the farmers' perception. Those were information receiving sources and occurrence of a pest attack in their farmer fields. Since the farmers are having limited resources to get essential information, they are unable to find recommended technologies to control all these four pests.

Furthermore, the study reveals that unawareness of technologies and low attention for coconut farming are the two major reasons for non-adoptability of recommended technologies. In addition, the result of the demographic characters shows that the younger generation's participation is very poor in coconut cultivation at the presence. This may be the result of deviation of teenagers in seeking reputed and respective jobs in the society without being a "farmer". Finally, it can be concluded that coconut growers in Kurunegala district require more awareness regarding recommended technologies to manage major coconut pests. For that purpose, farmer level extension programmes should be strengthened.

Acknowledgement

I would like to express my sincere gratitude to the Director, Additional Director and Deputy Director (Research) of the Coconut Research Institute of Sri Lanka for giving permission to carry out this study.

References

1. Central Bank Report of Sri Lanka (2016) Srilanka 6: 39-45.
2. Amarasinghe L, Nadarajah N, Gunathilake HA, Somasiri W (1994) Land suitability assessment of coconut growing areas in the coconut triangle.
3. Liyanage MD (1999) A guide to scientific cultivation and management of coconut. Coconut Research Institute, Lunuwila, Sri Lanka.
4. MPI (2008) Coconut Statistics. Ministry of Plantation Industry, Colombo 2, Sri Lanka.
5. Fernando LC, Manoj P, Hapuarachchi DC, Edgington S (2007) Evaluation of four isolates of Hirsutella thompsonii against coconut mite (Aceria guerreronis) in Sri Lanka. Crop Protection 26: 1062-1066.
6. Wickramananda IR, Peiris TS, Neil Fernando LC, Edgington S (2007) Impact of the coconut mite (*Aceria guerreronis keifer*) on the coconut industry in Sri Lanka.
7. Ranasinghe CS, Peiris TS, Jayawardane JK, Perera L, Fernando MT, et al. (2006) Coconut palm decline disorders: a survey on incidence and probable causes.
8. Jariko GA, Junejo MA, Rahpoto MS, Shah MZ (2011) Socioeconomic factors affecting adoption of sunflower varieties in Sindh. Pak J Commer Soc Sci 5: 192-201.
9. Peiris TS, Fernando MT, Appuhamy PA, Nainanayake NP, Bandaranayake CK (2006) Coconut research, development and dissemination of technologies-growers perception.