

## Awareness on Climate Change Impacts and Knowledge in Adaptation Strategies among the Coconut Growers in Kurunegala District of Sri Lanka

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### ABSTRACT

Climate change is one of the key areas that should be addressed today as it severely affects the crop productivity, including coconut. Therefore, awareness on climate change, its impacts to the coconut cultivation and possible adaptation strategies among the people who engaged in coconut sector are pivotal to reduce crop failures due to climate change. With these concerns, a study was conducted to assess the level of awareness on impacts of climate change and knowledge on adaptation strategies among coconut growers in Kurunegala District, where large proportion of coconut plantations are located. A pre-tested questionnaire was distributed among 200 coconut growers to gather primary data. Data were analyzed performing Descriptive Statistics and Kruskal-Wallis test using MINITAB 16 package. The results revealed that 85% of the respondents were aware about the term “climate change”. Majority of respondents defined climate change as either changes in temperature or changes in rainfall or drought. Further, coconut growers were highly aware (conscious) about yield fluctuations due to climate change nevertheless their degree of awareness on impacts on early stage of inflorescence development was poor. From the nine adaptation strategies enumerated, growers were highly aware about use of improved cultivars, moisture conservation and timely application of fertilizers, whereas their awareness was poor on rain water harvesting technique. Further, from the selected population, 85 - 90% practice mulching to conserve soil moisture in their plantations and 70 - 73% use improved varieties that give better yield compared to their own seedlings. The study suggested that initiating more awareness programmes, seminars to enhance the knowledge among growers and provision of more infrastructures to assist them to implement advanced adaptation strategies to overcome the negative effects of climate change.

**KEYWORDS:** Adaptation strategies, Awareness, Climate change, Coconut

### INTRODUCTION

Climate change is an emerging global issue faced by all over the planet today. It is expected to have serious environmental, economic and social impacts in all parts of the globe (Leonora *et al.*, 2013). Further, global surface temperatures are expected to increase by 1.4 °C to 5.8 °C by the end of this century (IPCC, 2007). This increasing temperature may also affect the change in rainfall pattern all over the world. Especially, plantation crops are strictly affected by such changes in rainfall and temperature.

Among the plantation crops in Sri Lanka, Coconut (*Cocos nucifera* L.) is important both as a food crop and as an industrial crop. Further, this is the most widely grown plantation crop in the country which covers an extent of 440,000 ha (Agricultural survey, 2014). From the coconut growing areas in Sri Lanka, Kurunegala, Puttalam and Gampaha districts forms the coconut triangle comprising 56.42% of the total coconut growing areas of the country (Gunaseena and Gunathilaka, 2013). The coconut industry contributed 0.8% to the

country's Gross Domestic Production (GDP) with an annual production of 2,500-3,000 million nuts (Anon, 2014a).

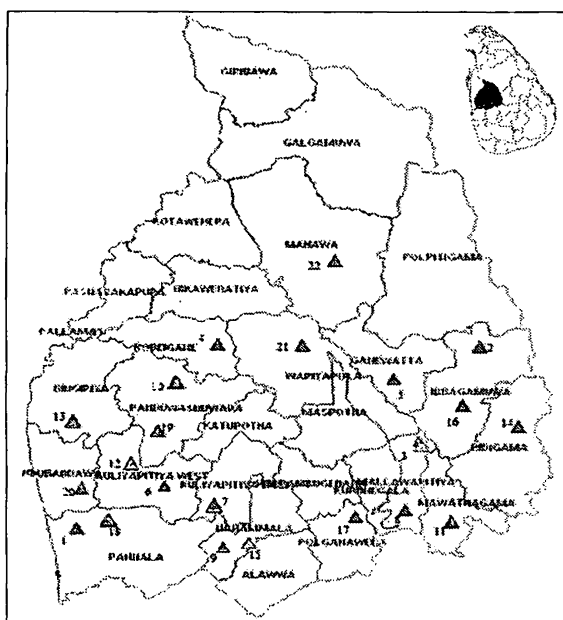
Coconut yield is strictly affected by changing rainfall and temperature as coconut palm is a continuous bearer and heavy water consumer. Fernando *et al.* (2007) reported that, 60% of the variation of coconut production can be explained by climatic variables. With these concerns, it is crucial to look forward on adaptation and mitigation strategies to climate change in order to overcome the yield reduction in coconut. Costa (2010) also reported that, mitigation and adaptation are the two principal pathways to minimize adverse impacts of climate change. Therefore, it is important to analyze the current situation of coconut growers in order to implement a new adaptation strategy or modify existing strategies to overcome the negative impacts of climate change. For instance, awareness about the issue, knowledge on adaptation strategies, problem related to the current strategies *etc.* Therefore, this study was conducted to assess the awareness on climate change, level of knowledge on adaptation

strategies and constraints faced by coconut growers with related to available adaptation strategies in Kurunegala district.

**METHODOLOGY**

**Study Area and Sampling**

The study was conducted in Kurunegala district located in North Western Province of Sri Lanka. This district has a total of 4816 km<sup>2</sup> land areas (Anon, 2014b). Coconut growing regions in Kurunegala can be divided in to two major Coconut Development Officer (CDO) divisions viz, Kurunegala and Kuliyaipitiya. Each region further divided in to sub CDO regions where Kurunegala includes 27 and 15 in Kuliyaipitiya. From these, 22 CDO regions; 12 from Kurunegala and 10 from Kuliyaipitiya were selected for the study (Figure 1).



**Figure 1. Selected coconut development officer regions in Kurunegala district.** 1- Welpalla, 2- Malsiripura, 3- Kudalgamuwa, 4- Kobeigane, 5- Ganewatta, 6- Kithalawa, 7- Horombawa, 8- Kurunegala, 9- Dambadeniya, 10- Hettipola, 11- Mawathagama, 12- Kuliyaipitiya, 13- Dummalasooriya, 14- Rambadagalla, 15- Narammala, 16- Ibbagamuwa, 17- Weerambagedara, 18- Yakwila, 19- Moonamaldeniya, 20- Udubaddawa, 21- Wariyapola, 22- Maho

A pre-tested semi-structured questionnaire was directed to gather data from 200 coconut growers (respondents) selected through stratified random sampling technique. These respondents represented 105 from Kurunegala division and 95 from Kuliyaipitiya division and face-to-face interviews were made to fill the questionnaire. The questionnaire consisted with five main sections namely 1- socio-economic variables, 2- growers' awareness on climate change, 3- knowledge on general impacts of climate change, 4- climate

change impact to the coconut, and 5- knowledge on adaptation strategies and related problems.

**Data Analysis**

Data were analyzed using Minitab 16 package. Descriptive statistics were used to analyze socio-economic variables and awareness on climate change. Further, the level of awareness on general impacts and impacts for the coconut sector by climate change and, knowledge on adaptation strategies were assessed using a 5-point Likert scale. Each question in above categories were rated 1-5 in which case 1-very low and 5-strongly aware for the positive statements. Weighted averages for the each statement were calculated referring the percentage score given for each statement by the selected expertise in the subject area. Kruskal-Wallis test was used to test the variation of the level of awareness with socio economic variables.

**RESULTS AND DISCUSSION**

**Descriptive Statistics of the Sample**

From the respondents in both areas, majority were male (85%, Kurunegala and 81%, Kuliyaipitiya) and among them, majority were in above 60 years (39%) in Kurunegala whilst 40-50 years (35%) in Kuliyaipitiya (Table 1).

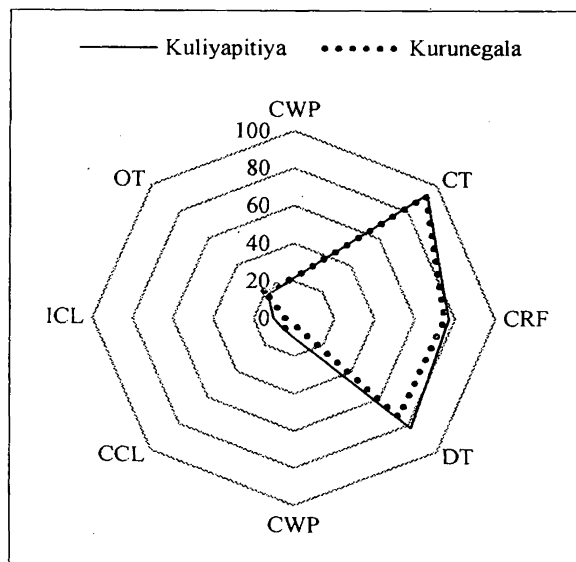
**Table 1: Socio-economic variables of the selected population**

	Kurunegala		Kuliyaipitiya	
	Frequency	Percentage (%)	Frequency	Percentage (%)
<b>Gender</b>				
Male	89	84.76	81	85.26
Female	16	15.24	14	14.74
<b>Age</b>				
Below 30 years	03	02.86	02	02.11
30-40 years	09	08.57	04	04.21
40-50 years	30	28.57	33	34.74
50-60 years	22	20.95	31	32.63
Above 60 years	41	39.05	25	26.32
<b>Education Level</b>				
No formal education.	10	09.52	06	06.32
Pass grade 8	18	17.14	12	12.63
GCE O/L	17	16.19	27	28.42
GCE A/L	40	38.10	42	44.21
Diploma	06	05.71	04	04.21
Degree	12	11.43	04	04.21
Post-graduate	02	01.90	00	00.00
<b>Experience on growing coconut</b>				
0-10 years	16	15.24	13	13.68
11-20 years	16	15.24	27	28.42
21-30 years	07	06.67	05	05.26
Above 30years	66	62.86	50	52.63

Further, large proportion from the population were exposed to formal education and amongst, majority were achieved up to GCE Advanced Level (38% in Kurunegala and 44% in Kuliypitiya). Only 11% in Kurunegala and 4% in Kuliypitiya were graduates. Sixty three percent of growers in Kurunegala division had more than 30 years of experience whereas in Kuliypitiya it was 53% (Table 1).

**Perception of Coconut Growers about Climate Change**

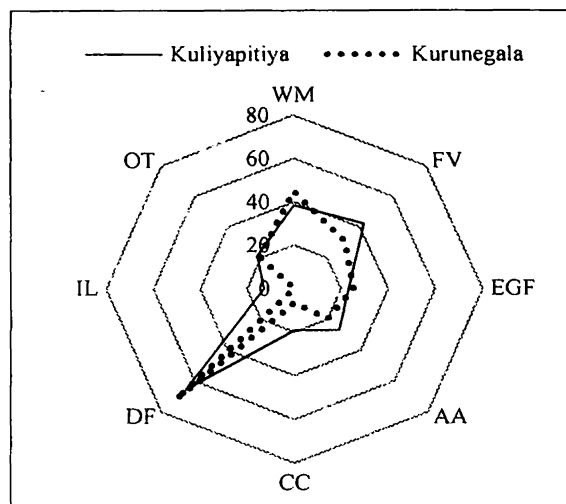
Eighty five percent of the respondents were aware and conscious about the term climate change. Majority of respondents were identified changes in temperature, changes in rainfall and drought as the primary climatic factors. Among them majority were defined changes in temperature as climate change (94 % in Kuliypitiya and 92 % in Kurunegala) (Figure 2).



**Figure 2. Coconut growers' perception on climate change.** CWP- changes in weather pattern, CT- changes in temperature, CRF- changes in rainfall, DT- drought, CWP- changes in wind pattern, CCL- increase CO<sub>2</sub> level, ICL- changes in cloud cover, OT- other

**Coconut Growers' Awareness on Factors Affecting for Climate Change**

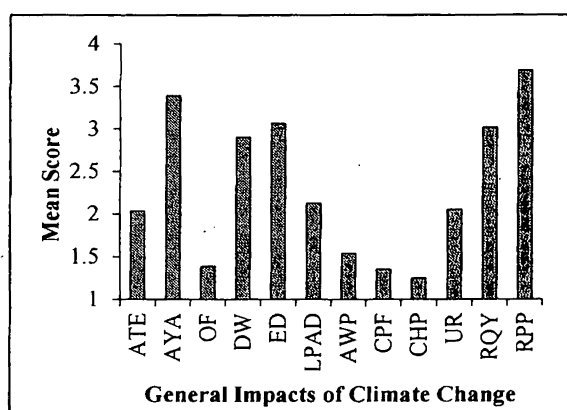
From the factors listed in the questionnaire (not showed), that are affecting for the climate change, majority of respondents (70%) were aware that deforestation as a factor and further 71% in Kurunegala and 65.38% in Kuliypitiya were rated it as the first or most affected factor. However, very few respondents (13%) in Kuliypitiya and no respondents in Kurunegala were aware that livestock farming is an active contributor for the climate change (Figure 3).



**Figure 3. Coconut growers' awareness on factors affect on climate change.** WM- environment pollution from waste materials, FV- from vehicles, EGF- exhaust gasses from factories, AA- agriculture activities, CC- chena cultivation, DF- deforestation, IL- increment of livestock, OT- others

**Coconut Growers' Awareness on General Impacts of Climate Change to the Environment**

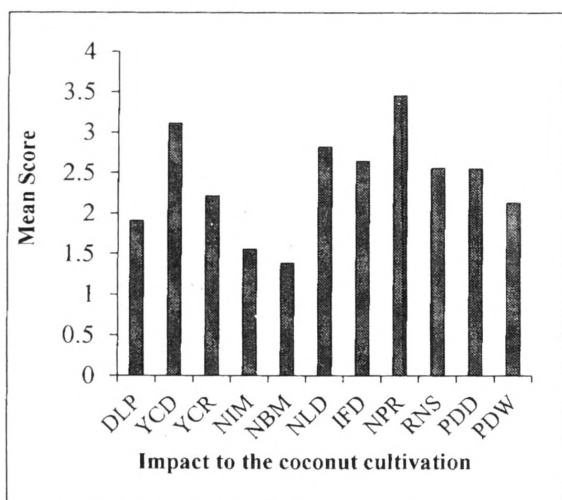
No significant difference ( $p > 0.05$ ) was observed between two main regions with respect to the degree of awareness among coconut growers on general impacts of climate change. The respondents were highly aware about yield reduction (3.69) due to climate change whilst their least attention was on changes of harvesting period (1.25) (Figure 4). Delay in harvesting (which falls between 45 to 60 days interval) could be the reason for above.



**Figure 4. Mean score values vs. level of awareness on general impacts of climate change.** ATE- Aquatic and terrestrial ecosystems, AYA- Alter yield of agriculture, OF- Occurrence of flooding, DW- Drying of water sources, ED- Extend of drought LPAD- Loss of plant and animal biodiversity, AWP- Alter weed and pest population, CPF- Change physiological functions of animals, CHP- Change harvesting period, UR- Unexpected rain, RQY- Reduce quality of yield, RPP- Reduce productivity per plant

**Growers' Perception on Impacts of Climate Change for the Coconut Cultivation**

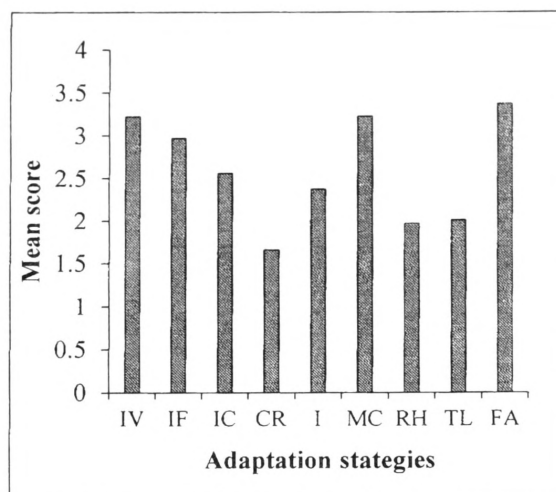
Coconut growers in Kurunegala district were highly aware of nut reduction during drought (3.5), however their awareness on button nuts production (female flowers) related to climatic variables were very poor (1.4) (Figure 5). The number of female flowers produced in an inflorescence is one of the important yield determinant factors in coconut (Ranasinghe *et al.*, 2015). Therefore, they must be made aware about this; so that they will be able to estimate the yield they will receive in future and take necessary adjustments.



**Figure 5. Mean score values vs level of awareness on climate change impacts on coconut cultivation.** DLP- Delaying land preparation, YCD- Young plant casualties are high in drought, YCR- Young plant casualties are high in excess rainfall, NIM- Higher number of inflorescence open in favourable months, NBM- Higher number of button nuts open in favourable months, NLD- Nut setting low in drought, IFD- Immature nuts falling is high in drought, NPR- Number of nuts reduce per palm in drought, RNS- Reduce nut size in drought, PDD- Certain pest and disease are higher in drought, PDW- Certain pest and disease are higher in wet period

**Coconut Growers' Knowledge on Adaptation Strategies**

Coconut grower respondents were highly aware about use of improved cultivars (3.22), moisture conservation (3.225) and timely fertilizer application (3.365) as adaptation measure for yield reduction in coconut due to climate change (Figure 6). Among other improved varieties majority of respondent apply Tall (TT) variety to obtain higher coconut yield. However, their awareness on rain water harvesting, timely land preparation and intercropping were poor. This is one of the important factors that we have to address when implementing awareness programs to the coconut growers.



**Figure 6. Perception about adaptation strategies.** IV- Improved varieties, IF- Integrated farming, IC- Inter cropping, CR- Crop rotation, I- Irrigation, MC- Soil moisture conservation, RH- Rain water harvesting, TL- Timely land preparation, FA- Timely fertilizer application

From the selected population, most of the coconut growers (85%) are practicing mulching to conserve soil moisture in their plantations in Kurunegala and 90% in Kuliyaipitiya (Table 2). Meanwhile, 70-73% is using improved varieties. Further, 83% of the respondents were growing intercrops with coconut. Banana, pineapple, pepper, betel, vanilla, vegetables and cut flowers are popular among coconut growers in Kurunegala District.

**Table 2. Adaptation strategies currently practiced by coconut growers**

Strategies	Kurunegala		Kuliyaipitiya	
	Frequency	Percentage (%)	Frequency	Percentage (%)
Use improved Varieties	66	72.53	54	69.23
Integrated farming	62	68.13	41	52.56
Timely fertilizer application	77	84.62	67	85.90
Irrigation	31	34.07	31	39.74
Soil conservation	65	71.43	58	74.36
Mulching	77	84.62	70	89.74
Cover cropping	23	25.27	36	46.15
Burying husks in pits	16	17.58	13	16.67

The study revealed that the major constraint faced by the coconut growers are lack of capital (41%) and lack of labor (46%) to implement some of the adaptation strategies (data not shown). This could be the reason for low adaptation percentage on construction of husk pits, irrigation and cover cropping (<50%; Table 2).

### ***Impact of Socio-Economic Variables on Level of Awareness and Knowledge on Adaptation Strategies among Coconut Growers***

Socio-economic variables such as area, age and their experience on coconut cultivation were not significantly ( $p > 0.05$ ), affected for the awareness on climate change among farmers, however, a significant ( $p < 0.05$ ) difference could be observed between education level of the respondents and the awareness (Table 3).

**Table 3. Effect of education level on the level of awareness and knowledge on adaptation strategies**

Education level	Impacts of climate change		Adaptation strategies
	General	On coconut	
No formal education	2.127	2.776	2.991
Pass grade 8	2.145	2.854	3.044
GCE O/L	2.624	2.949	2.853
GCE A/L	2.945	2.960	3.430
Diploma	3.470*	3.700*	3.652
Degree	3.169	3.267	3.776*
Postgraduate	2.344	2.401	2.907
<b>P value</b>	<b>0.000</b>	<b>0.032</b>	<b>0.003</b>

\*Highest weighted average score

### **CONCLUSIONS**

This study revealed that 85% of the respondents were aware about the term, climate change. Majority of respondents were defined climate change by means of changes in temperature or changes in rainfall or drought. They believe that deforestation is the major factor which affect for the climate change. Yield fluctuation due to climate change is the most significant and most sensing issue for the coconut growers in Kurunegala district.

Furthermore, majority of the farmers were applying mulch to conserve soil moisture and protect their plantations from drought induced yield failures. However, lack of capital and lack of labour obstruct adopting advanced adaptation methods to reduce the risk of climate change. Farmer education would improve the level of awareness and therefore initiation of awareness programmes, training workshops, seminars on climate change related topics can be suggested to strengthen the knowledge and awareness among coconut growers.

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