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Original article

Evaluating the Ethno-Climatological Knowledge and Its Applications for Mitigation of Climate Change Impact on the Uva High-Grown Organic Tea Ecosystem in Sri Lanka

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Abstract

The organic tea cultivation sector is confronted with significant challenges due to the adverse effects of climate change, necessitating the urgent implementation of effective adaptation strategies. Ethno-climatology is an interdisciplinary field focusing on understanding how diverse cultures and communities perceive, adapt to, and interact with their environment's climate and weather patterns. This study aims to evaluate the extent of ethno-climatology knowledge among organic tea farmers in the Uva High Grown region and examine their implementation of adaptation measures to address climate change challenges. Utilizing a cross-sectional and exploratory research design, this study employed a diverse data collection method, including in-depth interviews, focus group discussions, expert consultations, field observations, and questionnaire surveys, to ensure a comprehensive and multifaceted approach to data gathering. These methodological approaches facilitated the collection of valuable insights into farmers' awareness levels and their adoption of mitigation practices. Subsequently, the collected data were analyzed to discern the farmers' knowledge and implementation of adaptation measures in response to climate change challenges. The findings revealed a substantial majority of farmers displaying a notable level of awareness regarding ethno-climatology, with scores exceeding 75%. Additionally, approximately 37 farmers demonstrated a high level of awareness, scoring above 85%. These findings indicate a promising trend of increasing awareness among farmers. Correlation analysis further revealed that factors such as age, experience, and practical knowledge, experience, observations, personal beliefs, and cultural practices played pivotal roles in shaping farmers' awareness and comprehension of ethno-climatology. Conversely, variables such as education level and the number of information sources exhibited weak or non-significant relationships with awareness levels in the specific field of ethno-climatology. Multiple regression analysis was employed to identify independent variables significantly influencing farmers' awareness of ethno-climatology, explaining a substantial 96.2% of the observed variance in the dependent variable. As revealed by this research, the perception of the organic farming community offers valuable insights into the current status of ethno-climatology knowledge and the adoption of adaptation measures within the organic tea ecosystem. In conclusion, this study emphasizes the importance of implementing effective adaptation strategies in the organic tea cultivation sector in the Uva High Grown region, given the challenges posed by climate change. The findings contribute valuable insights into the current state of ethno-climatology knowledge among organic tea farmers and inform the implementation of adaptation measures.

Keywords: Climate resilience, Ethno-climatology, Organic tea cultivation, Awareness level, Mitigation measures.

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INTRODUCTION

Sri Lanka experiences a tropical climate, featuring coastal temperatures between 27°C to 30°C, while the central highlands may experience cooler temperatures as low as 16°C. Rainfall patterns vary across the island, with annual precipitation levels ranging from under 900mm to as high as 5500mm in different regions (Marambe et al., 2015). Agriculture in Sri Lanka has adapted to these diverse climate conditions, especially in tea cultivation, where elevation plays a vital role in categorizing different regions (Jayasinghe et al., 2020). The Uva High Grown region is renowned for its thriving tea production. Its elevated terrain, temperate climate, sufficient rainfall, and mist-shrouded landscapes provide unique tea-growing conditions. However, climate change has disrupted tea farming in the Uva region, as changes in precipitation patterns and temperature fluctuations have become major concerns affecting the productivity of tea plantations (Wijeratne et al., 2007).

To address the complicated concerns of climate change, it is critical to combine conventional knowledge with ethno-climatology and thoroughly understand the regional climate. Climate knowledge and its application in reducing the effects of climate change on tea plantations are critical to the agricultural sector's long-term viability and production. Understanding climatic patterns, temperature changes, rainfall distribution, and extreme weather events can aid tea growers in making informed decisions and implementing adaptive methods. This study aims to combine these two types of information, giving farmers the tools they need to adapt to a quickly changing environment and build resilience.

Organic tea production avoids the use of synthetic chemicals such as pesticides, fungicides, herbicides, growth regulators, and concentrated fertilisers. Instead, it depends on naturally existing minerals and the use of organic manures, both bulky and concentrated. Organic tea farmers prioritise using resistant cultivars, microclimate adjustment, and introducing biological control agents or naturally extracted biological products, all without resorting to inorganic solvents (Seyis et al., 2018). Therefore, it is critical to recognise the importance of traditional knowledge in organic tea cultivation and investigate the function of ethno-climatology in increasing productivity and creating resilience to the effects of climate change (Raghuvanshi and Ansari., 2017). Ethno-climatology is the study of climate recollects from a certain period and their ancient repercussions on the people and environment in that location as obtained from traditional knowledge of local culture and people (Kallio et al., n.d.). Understanding ethno-climatology equips farmers with valuable insights into historical weather patterns and their profound influence on local ecosystems and communities. By integrating this knowledge into agricultural practices, farmers can adapt their cultivation techniques to withstand better changing climatic conditions, ultimately ensuring the sustainability and success of their tea crops.

This research aims to fill a gap by exploring the significance of local knowledge and ethno-climatology in the context of organic tea farming practices in Sri Lanka's Uva High-Grown region. The findings of this study will be valuable for decision-making, policy development, and the promotion of sustainable farming practices in the area.

Objectives

The main objective of this study was to assess the organic tea farmers' knowledge of ethno-climatology, their perceptions regarding climate change and resilience strategies, and to identify the key factors influencing their awareness of ethno-climatology.

CONCEPTUAL FRAMEWORK

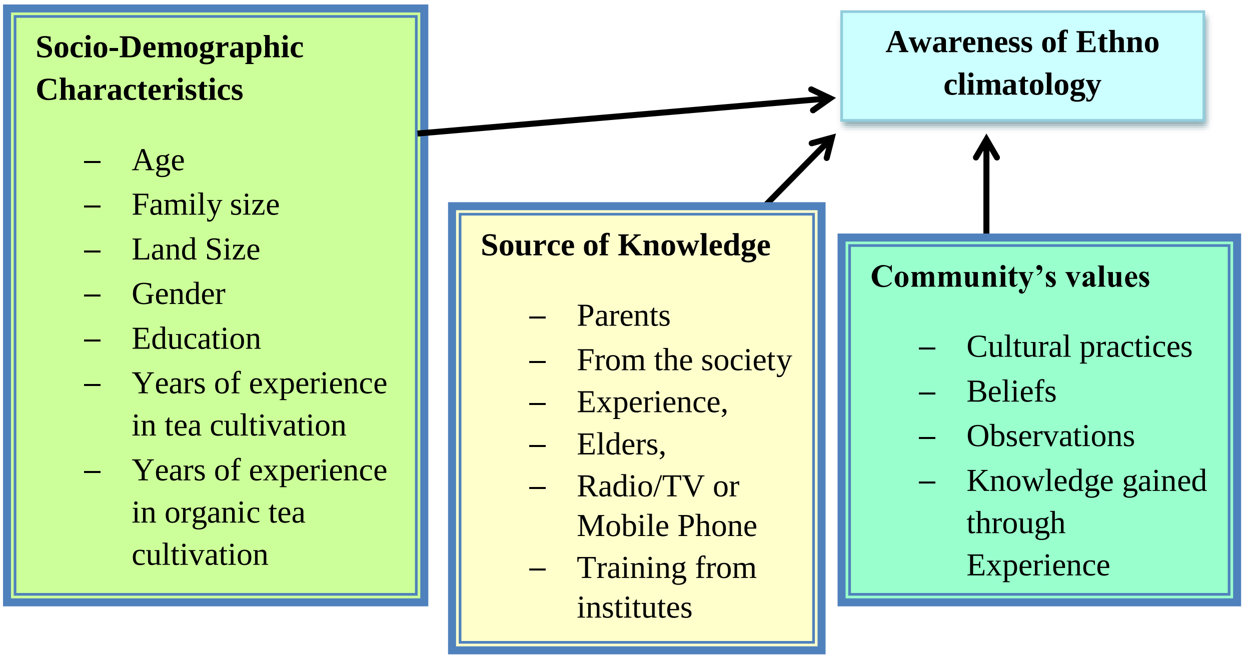

Figure 1. Conceptual framework of the study (*Bigirimana et al., 2011; Mekonnen et al., 2021)*

The conceptual framework for this study contains three main categories of independent variables: Socio-Demographic Characteristics, Source of Knowledge, and Community Values. The primary focus of the study is on the dependent variable, which is "Awareness of Ethno-climatology." Within the Socio-Demographic Characteristics category, we analyzed the influence of various factors on awareness of ethno-climatology. The Community's Values aspect investigates the cultural and belief systems that exist within the tea farming community.

METHODOLOGY

This study was carried out in the Uva High Grown region (above 1200 m a.m.s.l) of Sri Lanka, specifically in the villages of Piyarapandowa, Millawaththa, Kotakithula, Mahathenna, and Karagahapathana, where organic tea production is more prevalent. The study population consisted of organic green tea leaf suppliers to the Diyathalaw Avonleahill Organic & Biodynamic Tea Factory, comprising 500 organic tea farmers. Using a random sampling technique, 100 farmers were selected to participate in the study. The tea cultivators in the households were interviewed using a pretested structured questionnaire. Utilizing a cross-sectional and exploratory research design, this study employed a diverse data collection method, including in-depth interviews, focus group discussions, expert consultations, field observations, and questionnaire surveys, to ensure a comprehensive and multifaceted approach to data gathering.

To assess the level of ethno-climatology awareness and experience-based knowledge among organic tea growers, a 5-point Likert scale questionnaire was implemented. This questionnaire consisted of structured questions to gather information about participants' socio-demographic characteristics, including age, gender, education level, years of experience in tea and organic tea cultivation, land area, family size, and community values.

Reliability Test

The survey instrument was pretested and validated by applying reliability analysis. The reliability test results show that the items within each variable consistently measure their intended constructs. "Knowledge gained from experience" ($\alpha = 0.80$) and "Awareness of Ethno Climatology" ($\alpha = 0.90$) demonstrate satisfactory internal consistency.

After completing a comprehensive questionnaire, the collected data was subjected to several rigorous procedures, including cleansing, refining, coding, and entry into an Excel spreadsheet. Subsequently, the data was analyzed using SPSS software. In a study conducted by Amarathunga (2019), an index was used to evaluate the level of familiarity and understanding among farmers with regard to ethno-climatology. This approach ensured that the evaluation was conducted systematically.

$$\text{Index} = \frac{\text{Scores achieved by farmer}}{\text{Total potential scores}} \times 100 \qquad [1]$$

Correlation and regression analyses were performed to explore the relationships between organic tea growers' knowledge, perception, and adaptation level regarding climate change and to assess the impact of independent variables on dependent variables.

RESULTS AND DISCUSSION

Socio-Demographic Profile of the Farmers

Table 1. The respondent's socio-demographic profile.

Demographic variables	N	Minimum	Maximum	Mean	Std. Deviation
Gender	-	-	-	-	-
Male	64	-	-	-	-
Female	36				
Age (years)	100	30.0	83.0	55.52	11.90
Education (years)	100	1.00	27.00	11.03	5.23
Number of family members	100	02	07	4.29	1.08
Experience in the tea field (years)	100	06	53	27.71	9.54
Experience in the Organic tea field (years)	100	02	15	8.47	2.84
Land extends (acres)	100	0.19	2.00	0.76	0.46

Most of the sample comprises male farmers, with an average age of 55 years and 11 years of education. These farmers also have an average of 27 years of experience in tea cultivation, including 8 years of experience in organic tea farming. On average, they cultivate tea on 0.76 acres of land.

Perception on Climate Change

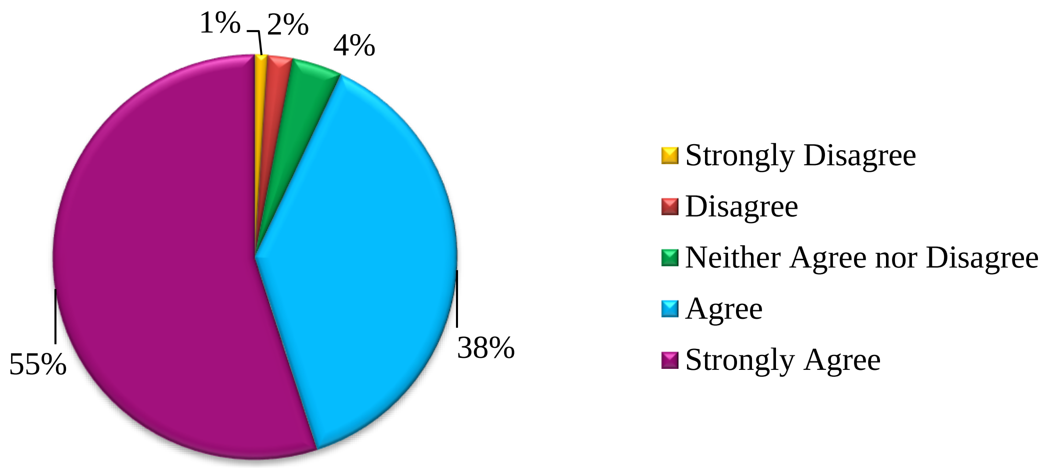

Figure 2. Organic tea smallholders' perception on climate change

Numerous research studies have indicated that rural communities take proactive measures to meet the challenges posed by climatic variations (Kirkland, 2012). The descriptive summary results explore the perceptions of climate change among organic farmers. The survey measured their level of agreement or disagreement with climate change-related claims, which were divided into five categories ranging from "Strongly Disagree" to "Strongly Agree."

Of the organic farmers surveyed, only one held a strong disagreement with climate change, while two expressed disagreement with the concept. This indicates that the majority of farmers in the sample do not have a strong disagreement in climate change. A substantial number of organic farmers, 38 individuals, agreed with the existence of climate change and recognized its impact on their agricultural practices. The majority of organic farmers, 55 individuals, strongly affirmed the reality of climate change and firmly believed that it was affecting their farming activities. These observations align with findings from Rakai and Isingiro Districts in Uganda (Tolo et al., 2014), where local communities are also aware of trends in climate variability and change in their respective areas. The study conducted in the Puththalm district of Sri Lanka by Godage and Gajanayake (2022) also found that, based on observations related to climate-change dimensions, most respondents felt that significant changes have occurred in various parameters of climate change.

The survey results of organic farmers' perspectives on climate change show that most participants recognise the facts and consequences of climate change. A sizable proportion of farmers strongly support this viewpoint, whereas a smaller proportion hold opposing views or stay neutral. This understanding of climate change is critical for organic farmers as they try to adopt farming methods to reduce its impact and ensure the sustainability of tea cultivation (Figure 2).

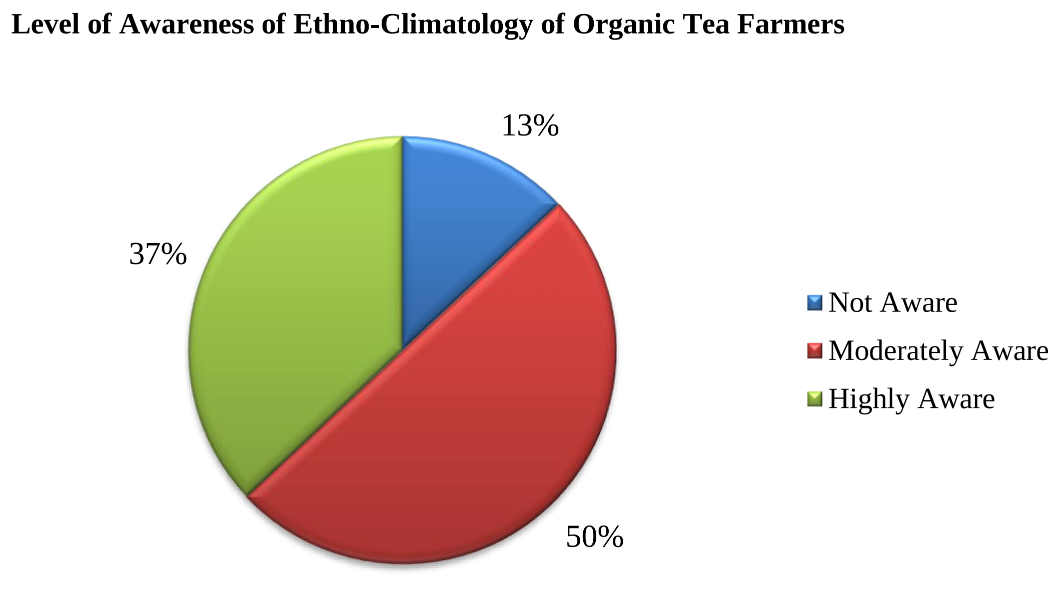

Figure 3. Level of Awareness on ethno-climatology of organic tea farmers

Farmers were surveyed using a 29-statement questionnaire focused on ethno-climatology knowledge related to various aspects such as Pruning Time and Management Practices, Shade Management, Soil Management, Plucking, and the impact of weather. The questionnaire was graded on a Likert scale to measure their understanding of ethno-climatology. The results were collated and indexed to establish the degree of awareness. Interestingly, more than half of the farmers scored more than 75%, showing a thorough mastery of the subject. While a few people scored below the threshold, the majority scored in the moderate to high range, with 37 demonstrating a thorough grasp. These findings indicate a growing awareness among farmers (Figure 3).

Farmer’s Perception of the Influence of Climate Change on Tea Cultivation

Farmers' opinions provide important insights into climate change's multidimensional influence on tea cultivation, which includes yield decline, increased pest and disease challenges, soil deterioration, increased weed proliferation, and degraded growing conditions (Figure 4).

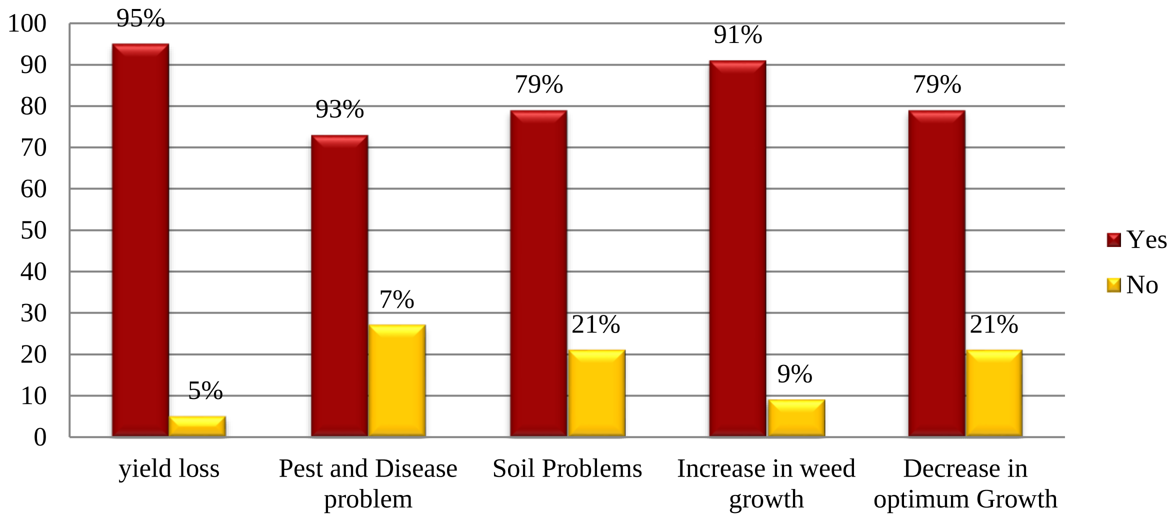

Figure 4. The organic farmer’s perception of climate change's influence on tea cultivation

Remarkably, 95% of respondents reported tea yield reductions, demonstrating the crop's susceptibility to climate-related issues, which could lead to economic setbacks. Wijeratne et al. (2007) found a polynomial relationship between monthly rainfall and tea yield. This data implies that the previous month's rainfall considerably impacts the current month's productivity. This confirms that farmers' assessments of this matter are accurate. A sizable majority (73%) reported pest and disease problems increases, indicating that climate change is encouraging their expansion and threatening plant health. 79% of respondents highlighted soil degradation problems caused by climate change, including erosion, nitrogen loss, and moisture changes, which jeopardise the overall viability of tea plants. 91% of respondents reported an increase in weed growth, which may compete with tea plants for nutrients and water. Furthermore, 79% reported a drop in optimum growing circumstances, which could reduce yields, quality, and phenological patterns. These findings highlight the critical need to implement adaptation methods to ensure the long-term viability of tea production in the face of climate change impacts.

Tolo et al. (2014) found that climate variability and change considerably affected subsistence agriculture. These impacts, listed in decreasing order of severity, include decreased crop yield, more frequent pest and disease outbreaks, higher incidences of droughts and floods, limited access to water, and unpredictable rainfall patterns, among other things. These issues have had a significant influence on agricultural activity in the villages. Bigirimana et al. (2011) conducted a study in Rwanda and found that weather unpredictability had negative effects on agricultural outcomes, including poor harvests, aberrant crop growth, insect and disease outbreaks, crop wilting, and even crop extinction.

Adaptation measures used by organic farmers

Table 2. Adaptation measures used by organic farmers.

Adaptation Measure	Percentage	Ranking
Soil Conservation and Management	88	1
Weed Management	83	2
Use of tolerant cultivars	79	3
Integrated Pest Management (IPM)	74	4
Shade Management, Agroforestry and Windbreaks	72	5
Irrigation Management	65	6

According to the findings, 88% of farmers apply soil conservation measures to maintain soil health, and 83% use effective weed management to keep tea plants healthy. The vast majority of producers (79%) have chosen adaptable tea varieties for planting to survive climate problems. To reduce pest damage during dry weather, 74% of farmers use Integrated Pest Management (IPM) approaches, which incorporate multiple pest management measures. IPM is an environmentally friendly pest control strategy that reduces the usage of chemical pesticides while yet efficiently managing pest populations. Furthermore, 72% of farmers use shade management, agroforestry, and windbreak techniques to improve microclimates and increase biodiversity in tea plantations. Finally, over 65% of farmers adopt irrigation management systems that account for shifting water availability trends (Table 2). Farmers used specific adaptation strategies to cope with climate change.

Wijeratne et al. (2007) mentioned several adaptation methods related to tea cultivation, including the use of drought-tolerant cultivars, the establishment of shade and high-intensity intercropping systems, soil improvements aimed at conserving soil and moisture, the addition of organic matter, soil conservation measures, in-situ generation of compost and its incorporation into soil, the establishment of SALT (Sloping Agriculture Land Technology) hedge rows, envelope forking (loosening the soil without turning), burying of pruning, mulching in young tea plantations, and irrigation management. According to the study's findings, many of these adaptation methods are already being implemented by organic tea farmers. However, there is room to further implement and develop these practices in organic tea cultivation in Sri Lanka.

Correlation Analysis

Upon analysis of the correlation table, it was discovered that various factors have a positive association with ethno-climatology awareness among farmers. These factors include age, experience in both conventional and organic tea fields, cultural practices, knowledge acquired through experience, beliefs, and observations. This implies that as farmers age, gain more experience in tea cultivation, engage in more cultural practices, acquire knowledge through experience, hold strong beliefs, and make more observations regarding tea farming, their awareness of ethno-climatology increases (as evidenced in Table 3).

However, variables such as education level, number of family members, land extent, and number of information sources used do not demonstrate significant correlation with ethno-climatology awareness. These factors do not exhibit a robust linear relationship with the farmers' level of awareness (as shown in Table 3).

Table 3. Correlation between level of awareness about ethno-climatology and independent variable.

Component	Awareness of Ethno-Climatology	
	Pearson Correlation	Sig. (2-tailed)
Age (years)	0.93*	0.00
Education (years)	0.08	0.44
Number of family members	0.10	0.34
Experience in tea cultivation (years)	0.91*	0.00
Experience in Organic tea farming (years)	0.96*	0.00
Land extends (acres)	0.14	0.18
Number of sources	0.13	0.19
Cultural practices	0.46*	0.00
Knowledge gained through experience	0.91*	0.00
Beliefs	0.92*	0.00
Observations	0.93*	0.00

*Correlation is significant at the 0.01 level (2-tailed).

It is important to highlight that in a study conducted by Bigirimana et al. (2011), the use of one-way analysis of variance indicated that variables such as age, family size, land size, the period spent, and income significantly influenced communities' awareness of local knowledge in climate (ethno-climatology).

Multiple regressions Analysis

Empirical model

An empirical model was developed to establish the relationship between dependent and independent variables as follows

$$\textbf{Awareness level} = \beta 0 + \beta 1(X1) + \beta 2(X2) + \beta 3(X3) + \beta 4(X4) + \beta 5(X5) + \beta 6(X6) + \beta 7(X7) + \beta 8(X8) + \beta 9(X9) + \beta 10(X10) + \beta 11(X11) + \beta 12(X12) + \varepsilon$$

Y- Awareness level
$\beta 0$- Coefficient of Constant
X1 - Gender
X2 - Age
X3 - Education
X4 - Family size
X5 - Experience in tea cultivation
X6 - Experience in organic tea cultivation
X7 - Land Extent
X8 - Number of Sources
X9 - Cultural Practices
X10 - Knowledge gained through experience
X11 - Observations
X12 - Beliefs
ε-Error

Analysis of Variance (ANOVA) and Model Summary

The regression analysis produced a significant model (F=185.96, $p<0.001$). This indicates that the predictors explain a substantial amount of the variance in the dependent variable.

The correlation coefficient is 0.981, indicating a strong positive correlation between the independent variables and the dependent variable. The coefficient of determination (R^2) value of 0.962 suggests that approximately 96.2% of the variance in the dependent variable can be explained by the predictors in the model. The adjusted R^2 value is 0.957, implying that approximately 95.7% of the variance in the dependent variable can be explained, accounting for the complexity of the model and sample size. The standard error of the estimate is 1.54896, indicating the average error when predicting the dependent variable based on the independent variables.

A correlation coefficient of 0.98 indicates a strong positive correlation between the independent and dependent variables, suggesting a close relationship. Furthermore, the coefficient of determination (R^2) value of 0.96 indicates that the independent factors account for 96.2% of the observed variance in the dependent variable. This finding indicates that the independent variables considerably impact the dependent variable and can accurately explain its variability.

Table 4 shows the findings of a study that looked at the elements that influence awareness of ethno-climatology. Standardised coefficients (Beta) were utilised to assess the relationships between predictor variables and awareness. The Beta score for Gender is -0.52, indicating a modest negative relationship between gender and awareness of ethno-climatology. However, the p-value of 0.14 exceeds the standard significance level of 0.05, indicating that the link is not statistically significant.

Table 4. Relationship between Independent and Dependent variable

Components	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	50.89	2.29		22.25	0.00
Gender	-0.52	0.35	-0.03	-1.49	0.14
Age (years)**	0.13	0.05	0.20	2.64	0.01
Education (years)	0.04	0.03	0.03	1.30	0.20
Number of family members	-0.04	0.15	-0.01	-0.24	0.81
Experience in tea cultivation (years)	0.00	0.06	0.00	0.05	0.96
Experience in Organic tea cultivation (years)***	0.88	0.23	0.34	3.82	0.00
Land extent (acres)	-0.30	0.36	-0.02	-0.83	0.41
Number of sources	-0.02	0.14	-0.00	-0.16	0.87
Cultural practices	0.15	0.15	0.03	1.06	0.30
Knowledge gained through experience**	0.10	0.04	0.14	2.64	0.01
Beliefs**	1.43	0.51	0.16	2.80	0.01
Observations***	1.14	0.37	0.19	3.06	0.00

Dependent Variable: Awareness of Ethno-Climatology

*Significant at 0.1 significance level, **Significant at 0.05 significance level, ***Significant at 0.01 significance level

As a result, based on this sample, we cannot conclude that gender influences awareness of ethno-climatology Nevertheless, as noted by Bigirimana et al. (2011), awareness does have a connection to sex. Gender disparities in weather forecast knowledge are often attributed to differences in individuals' ability to acquire information. In contrast, the beta value for Age is 0.13, indicating a positive association. Participants' awareness of ethno-climatology tends to increase as they get older. The p-value for Age is 0.01, indicating statistical significance in this sample.

The unstandardized coefficient for Education (years) is 0.04, suggesting a positive relationship. However, with a p-value of 0.20, which exceeds the conventional threshold of 0.05, there is no statistical significance. Therefore, we cannot assert that education significantly influences awareness of Ethno climatology in this study. Despite the assumption that higher education levels correlate with greater weather prediction awareness, our findings suggest otherwise. Notably, there appears to be a significant disparity between individuals with formal education and those with informal education regarding their ability to predict weather using traditional indicators (Bigirimana et al., 2011).

Although the results suggest negative relationships between the coefficients for the Number of Family Members and Land Extent (Acres), these findings are not statistically significant, with p-values of 0.81 and 0.41, respectively. Interestingly, Experience in the tea cultivation shows little to no influence on awareness of ethno-climatology, as indicated by a coefficient of 0.00 and a p-value of 0.96.

Conversely, Experience in the organic tea cultivation demonstrates a strong positive correlation with awareness, with a Beta of 0.34 and a statistically significant p-value of less than 0.05. These results indicate that individuals with greater experience in organic tea cultivation tend to possess a higher level of Ethno-Climatology awareness.

The analysis shows that there is a positive correlation between Cultural practices and the response variable, with a coefficient of 0.15. However, the p-value of 0.30 indicates that this correlation is not statistically significant. On the other hand, Knowledge gained through experience has a significantly greater impact on the response variable ($p = 0.01$) with an unstandardized coefficient of 0.10. This suggests that increased knowledge from experience is linked to a heightened sense of awareness. Beliefs play a significant role in shaping individuals' awareness of ethno-climatology, with a statistical significance of $p = 0.01$. The unstandardized coefficient of 1.43 suggests that individuals with stronger beliefs are more likely to have a higher awareness of Ethno-climatology. Furthermore, Farmers' Observations are positively associated with ethno-climatology awareness, as evidenced by the unstandardized coefficient of 1.14 and a significant p-value of 0.00. However, the number of sources used by participants for knowledge has an unstandardized coefficient of -0.02, indicating a negative relationship that is not statistically significant with a p-value of 0.87.

In 2011, Bigirimana et al. conducted a one-way analysis of variance to assess the influence of age, family size, land size, time spent, and income on communities' awareness of traditional Knowledge for predicting weather variability. The findings indicated that only family size had a statistically significant positive impact on communities' awareness of traditional weather forecast methods.

In summary, this analysis indicates that specific predictor variables, including age, experience in organic tea cultivation, knowledge acquired through experience, personal beliefs, and observations, exhibit a significant correlation with awareness of Ethno-climatology within the sample group. Conversely, other variables such as gender, education, family size, land extent , number of sources of information, and cultural practices did not demonstrate any statistically significant influence. According to this data, we can concur with the study of Bigirimana et al. (2011), which concluded that not all individuals possess knowledge about weather. This knowledge is only held by specific categories of people. Being aware of such knowledge is a gateway to understanding cultural beliefs within a given society.

Conclusion

The study findings reveal that a considerable proportion of organic tea farmers in the Uva High-Grown Region exhibit a notable level of awareness (37% exhibiting a high level of awareness, 50% have moderate awareness) regarding ethno-climatology.

Farmer's age, experience in organic tea cultivation, and knowledge gained through experience, beliefs, and observations were significant factors that positively influence farmers' awareness. These factors contribute to a more profound understanding and engagement with Ethno-climatology principles within the context of organic tea cultivation.

Conversely, variables such as gender, education, number of family members, experience in tea cultivation, land extent, number of information sources, and cultural practices did not demonstrate a statistically significant impact on awareness. This suggests that within the context of this study, these variables do not play a substantial role in shaping farmers' awareness levels of the subject under investigation, i.e. ethno-climatology.

The comprehensive study of farmers' opinions reveals a stark reality: climate change is substantially impacting all aspects of tea growing, from yield losses and increased pest incidences to soil degradation, weed proliferation, and degraded growing conditions.

According to the study findings, farmers have implemented effective strategies, such as utilizing tolerant crops, practising soil conservation, regulating pest and weed control, and implementing shade management to adapt to changing climatic conditions. However, enhanced irrigation is also essential to maximize the benefits of these efforts. These measures contribute to build resilience, sustainability, and organic integrity of tea production systems.

Hence, the findings of this study highlight that a substantial percentage of organic tea farmers in the Uva High-Grown Region exhibit notable awareness of ethno-climatology, influenced by factors like age, experience, knowledge, beliefs, and observations. Conversely, variables such as gender, education, family size, land extent, and cultural practices have minimal impact on awareness. The research emphasizes the pervasive influence of climate change on tea cultivation, prompting farmers to adopt effective climate resilience strategies for adaptation, including crop tolerance, soil conservation, pest and weed control, and shade management. However, optimal irrigation management is crucial to amplify these efforts. Climate knowledge and its application in mitigating the impact of climate change on tea plantations are crucial for the sustainability and productivity of tea smallholding sector. In addition to the above findings, understanding climate patterns, temperature variations, rainfall distribution, and extreme weather events can help tea growers make informed decisions and implement the climate resilient strategies to mitigate the adverse impact of climate change.

Implications

Encourage training and knowledge-sharing activities for organic tea farmers in Sri Lanka's Uva High Grown region.

Establish peer learning networks for farmers to share their expertise and experiences with climate change adaptation.

Invest in research and extension services focusing on organic tea cultivation and climate change adaptation.

Create a long-term monitoring and evaluation system to assess the impact of climate-smart resilience adaptation measures on tea production and organic farmers' livelihoods.

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