Evaluation of Impact of Climatic Factors on Tea Yield -A Case Study in Badulla Region

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Tea, *Camellia sinensis* is a perennial plant grown for decades sustaining various climatic conditions. The physiological activities of tea plants, including their growth and development, are significantly influenced by climatic parameters such as rainfall, temperature, sunshine hours, and relative humidity. Responses of tea plants for climatic parameters vary region wise. Therefore, this study was carried out to determine the impact of climatic parameters on tea yield in the Badulla region. Thirty years of climate and tea yield data were collected from Ury Estate, Badulla, and TRI Advisory and Extension Center, Uva and trend analysis was performed to determine changes in tea yield in response to climatic parameters. Lag periods were taken into consideration to analyze the effect of climatic conditions from previous months on tea yield. Three models were developed for green leaf yield, using Multiple Linear Regression, Generalized Linear Model, and Deep Learning. The linear relationship between tea yield and climatic parameters was identified through correlation analysis. The trend analysis showed significant trends with respect to different climatic parameters. Both green leaf and made tea yields have decreased over the years, due to climate change. Sunshine hours gave the highest positive correlation at a 5% significance level ($P \leq 0.05$) with both green leaf and made tea yield ($r = 0.40$ and $r = 0.45$). Average temperature also showed correlations ($r= 0.336$ and $r=0.383$) with green leaf and made tea yield respectively. Of the three models developed, the Deep Learning model demonstrated the best performance, exhibiting the least error value and the highest correlation ($r=0.73$) between actual and fitted values. Hence this model can be effectively utilized to predict tea yields based on changes in climate parameters of the studied locations of this study.

Keywords: Climate change, Machine learning, Regression analysis, Tea cultivation, Tea yield