Journal of Nature Studies 19(2): 52-61
Online ISSN: 2244-5226

MODELLING THE DAILY AVERAGE TEMPERATURE AND DESIGNING A GROWING DEGREE DAY (GDD) EUROPEAN PUT OPTION FOR RICE IN LAGUNA

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ABSTRACT – Weather conditions are primary influencer on rice production, causing unpredictable yield. Any unexpected variation and irregularity in the weather, such as fluctuation of temperature, may contribute to reduction of rice production. Weather derivatives are financial instruments that can be used to financially protect production risks related to weather variability. Thus, the objective of this study is to price a European put option, a type of weather derivative, in the province of Laguna, Philippines, with growing degree day (GDD), as the underlying index. Specifically, this study aims to find a differential equation model of the daily average temperature and to find appropriate GDDs as strike values for the contract. Daily minimum and maximum temperatures recorded from year 1960 to 2018 are collected. It is found that the average temperature in Laguna within the specified period is 26.88°C, and varies by 1.42°C. It is also found that temperature is expected to increase by 1.72°C in 100 years assuming that current situations persist. Using this information, the GDD option is priced. It is found that by paying choosing 1800 GDD and paying 0.13 PhP, the farmer can gain as much as 321.08 PhP if he exercises the option. The results of this study can help insurance providers and the government to design products that can help the farmers. This product is relatively cheaper than other financial contracts hedging against adverse weather conditions.

Keywords: European option, growing degree day, temperature model, time series, weather derivative

JOURNAL OF NATURE STUDIES
(formerly Nature's Bulletin)
Online ISSN: 2244-5226

To cite this paper: Poral, P.A.P., Angcao, J.L., Cuaresma, D.C.N., Dazo, N.A. & Rivera, V.J.B. 2020. Modelling the Daily Average Temperature and Designing a Growing Degree Day (GDD) European Put Option for Rice in Laguna. *Journal of Nature Studies*. 19(2), 52-61.