**Rice Yield Estimation Using Sentinel-2 with Remote Sensing and
Machine Learning in Thailand**

Pramet K., Jinnawat T., Phukrit, S. Yutthaphum, K. Sasithon, C., Panu, N.\*, and Sukij S.

1Geo-Informatics and Space Technology Development Agency (GISTDA), Bangkok, Thailand

\*panu.n@gistda.or.th (\*Corresponding author’s email only)

***ABSTRACT***

Rice stands as a pivotal economic crop in Thailand, playing roles as a staple food, a significant export, and a contributor to national food security. Thus, precise assessment of rice yields is paramount. With advances in remote sensing technology and machine learning, accurate yield estimation is now achievable. This study evaluates rice yields in Thailand's Central Plains during the 2018/2019 rice season, covering 50 parcels from December 2018 to April 2019 for growing and March to June 2019 for harvesting.

The dataset was divided into 80% for training and 20% for validation. From January to June 2019, Sentinel-2 images were processed using Google Earth Engine's Scene Classification Layer (SCL) to filter out clouds and cloud shadows. Various vegetative indices were examined to develop the rice phenology, which identifies the optimum periods for yield estimation based on maximum values.

The Simple Linear Regression model revealed significant correlations between rice yield and the maximum Normalized Difference Vegetation Index (NDVImax) with an R-square of 0.681, the maximum Green Normalized Difference Vegetation Index (GNDVImax) with an R-square of 0.639, and the minimum Normalized Difference Water Index (NDWImin) with an R-square of 0.629. Through Stepwise Selection, the model selected NDVImax and the minimum Bare Soil Index (BSImin) as key variables, resulting in an R-square of 0.720 and a Root Mean Square Error (RMSE) of 74.916 kg/ rai. These findings confirm the robust relationship between rice yield and satellite imagery.

This study underscores the importance of using remote sensing and machine learning techniques for agricultural monitoring, providing crucial insights to strengthen rice production management within GISTDA's agricultural application "Dragonfly".

**Keywords:** Regression model, Yield estimation, Sentinel-2, Rice, Thailand