

Basmati rice varietal differentiate using Sentinel-1 and Sentinel-2 data in Google Earth Engine

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A study on Basmati rice variety differentiation was carried out in two districts of Haryana, using Sentinel-1 SAR and Sentinel-2 MSI time series data and a Random Forest (RF) classifier on the Google Earth Engine cloud computing platform. The fortnightly composite stack of VH-VV difference and Sentinel-2 multispectral bands and their Red-edge indices, Chlorophyll Index (CI_{green} and $CI_{\text{red-edge}}$), was analysed. Basmati varieties could be distinguished into long- and short-duration and early Basmati. The accuracy of the RF classifier model was validated by computing the AUC and receiver operating characteristic curves. AUC was > 0.9 , ensuring the best model fitting and high accuracy. The results revealed that long-duration Basmati varieties are being replaced by shorter-duration varieties.

Keywords: Basmati rice varieties, Chlorophyll Index Red ($CI_{\text{red-edge}}$), Chlorophyll Index Green (CI_{green}), Google Earth Engine, Random Forest.

Remote sensing data from satellites has been widely applied by researchers for observing and mapping rice cultivation⁴⁻¹⁰, and this technology is now being used at an operational level in India for rice crop acreage. Crop condition assessment and yield forecasting are integral components of the FASAL (Forecasting Agricultural Output using Space, Agrometeorology and Land-based Observations) program by the Ministry of Agriculture and Farmers Welfare¹¹. However, discrimination among rice varieties and estimation of variety-specific acreage remain challenging. The production has achieved only limited success due to the mixing of spectral signatures of different rice varieties³. As regards Basmati rice, the earliest attempt in India to differentiate Basmati from other high-yielding variety (HYV) rice, and its area estimation was carried out using Indian Remote Sensing Satellite (IRS-1A) LISS-II data in the Karnal district of Haryana¹². The difference in phenological stages of Basmati and other HYV rice on the data acquired during the second to third week of October, 1989, resulted in different spectral signatures, making