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# Comparing Remote Sensing and in Situ Analyses of Test Wheat Plants as Means for Optimizing Data Collection in Precision Agriculture

**Authors :** Endalkachew Abebe Kebede, Bojin Bojinov, Andon Vasilev Andonov, Orhan Dengiz

**Abstract :** Remote sensing has a potential application in assessing and monitoring the plants' biophysical properties using the spectral responses of plants and soils within the electromagnetic spectrum. However, only a few reports compare the performance of different remote sensing sensors against in-situ field spectral measurement. The current study assessed the potential applications of open data source satellite images (Sentinel 2 and Landsat 9) in estimating the biophysical properties of the wheat crop on a study farm found in the village of OvchaMogila. A Landsat 9 (30 m resolution) and Sentinel-2 (10 m resolution) satellite images with less than 10% cloud cover have been extracted from the open data sources for the period of December 2021 to April 2022. An Unmanned Aerial Vehicle (UAV) has been used to capture the spectral response of plant leaves. In addition, SpectraVue 710s Leaf Spectrometer was used to measure the spectral response of the crop in April at five different locations within the same field. The ten most common vegetation indices have been selected and calculated based on the reflectance wavelength range of remote sensing tools used. The soil samples have been collected in eight different locations within the farm plot. The different physicochemical properties of the soil (pH, texture, N, $P_2O_5$, and $K_2O$) have been analyzed in the laboratory. The finer resolution images from the UAV and the Leaf Spectrometer have been used to validate the satellite images. The performance of different sensors has been compared based on the measured leaf spectral response and the extracted vegetation indices using the five sampling points. A scatter plot with the coefficient of determination (R2) and Root Mean Square Error (RMSE) and the correlation (r) matrix prepared using the corr and heatmap python libraries have been used for comparing the performance of Sentinel 2 and Landsat 9 VIs compared to the drone and SpectraVue 710s spectrophotometer. The soil analysis revealed the study farm plot is slightly alkaline (8.4 to 8.52). The soil texture of the study farm is dominantly Clay and Clay Loam.The vegetation indices (VIs) increased linearly with the growth of the plant. Both the scatter plot and the correlation matrix showed that Sentinel 2 vegetation indices have a relatively better correlation with the vegetation indices of the Buteo dronecompared to the Landsat 9. The Landsat 9 vegetation indices somewhat align better with the leaf spectrometer. Generally, the Sentinel 2 showed a better performance than the Landsat 9. Further study with enough field spectral sampling and repeated UAV imaging is required to improve the quality of the current study.

**Keywords :** landsat 9, leaf spectrometer, sentinel 2, UAV
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