

Estimating soybean yield using time series of anomalies in vegetation indices from MODIS

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Resumen. An accurate estimation of soybean yield while the plants are still in the field is highly necessary for industry applications and decision-making policies related to planning. Remote sensing is a powerful tool, due to its spatio-temporal coverage, for developing empirical models to predict and evaluate crop yields at regional and national scales.

In Argentina, soybean (*Glycine max* (L.) Merr.) is the most important crop, particularly in Córdoba province the 89% of the sown area and 88% of the production is concentrated in eleven departments. The objectives of this work were to evaluate the performance of three vegetation indices: Normalized Difference Vegetation Index (NDVI), Enhanced Vegetation Index (EVI) and Normalized Differential Water Index (NDWI), from Moderate Resolution Imaging Spectroradiometer (MODIS), to explain the anomalies in the soybean yield at department-level in Córdoba, and to develop regressions models for estimate this variable using anomalies of these indices and average crop yield, considering time series of historical records and different sources of data.

The results showed that the anomalies of the three vegetation indices fit, with very good precision, the anomalies of soybean yield (Pearson correlation coefficient values from 0.71 to 0.85). The evolution of the NDVI anomalies of mid-season crop development stage, for all periods considered, showed a similar pattern to yield anomalies, particularly differentiating years where droughts or highest soybean yields occurred, independently of data sources used. The regression models estimated soybean yield with NDVI anomalies, obtained prior to harvest, with % RMSE values between 8% and 17%.

These simple and versatile models show that using free MODIS data, we can produce reasonable real-time estimates of soybean yield at department-level without previous crop classification.

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Palabras clave: NDVI, Soybean, regression model, Córdoba-Argentina