



## Remote sensing technique for estimating soybean yield over large spatial scale

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The development of easy-to-use modeling tools for understanding the influence of inter-annual climate variations on crop yields in different regions is of high priority for modern agriculture. Given that the soybean is one of the most economically significant crops worldwide, the purpose of this study is to suggest a new method for estimating soybean crop yields over a large spatial scale. This was achieved incorporating the so-called “simplified triangle” remote sensing technique with the crop prediction model of Doorenbos and Kasim, 1979 (DK) and the climatological water balance model of Thornthwaite & Mather, 1955 (ThM). DK needs knowledge of evapotranspiration fraction (EF), defined as the ET divided by the net radiation (Rn). Generally, this ratio is obtained from climatological water balance models (CWBs), which require many archived surface data. In contrast, the proposed methodology presents an advance over existing crop yield estimation methods, since the EF is derived by simply remote sensing techniques. In detail, for assessing soybean crop yields, a simplified triangle remote sensing technique was combined overcoming the difficulties of scalability, giving cost effective predictions at large spatial scale. The proposed method was calibrated/validated using field measurements of soybean crop productivity for crop years 2002–03 to 2011–12. The simulated results are in a very good agreement with the observed field data using different statistical indices (MAE, RMSE, d1 and d2, c, R2, Ea and Es errors). It is also of high importance to mention that the RMSE showed remarkable small variation between 30.8 (kg/ha) to 57.2 (kg/ha). The proposed methodology could also be used to estimate soybean crop yields as a result of climatic change. All these approaches were implemented at one of the most productive agricultural regions of Brazil dominated by soybean crop.

Keywords: Crop productivity; Evapotranspiration; Soil moisture; Surface Soil; Triangle