

FIELD-BASED CANOPY HEIGHT ESTIMATION USING UAV IMAGES IMPROVES AFTER SPATIAL AND TEMPORAL ADJUSTMENT

FANIA F.*, SPADANUDA P.***, PECCHIONI N.***, PECORELLA I.***, DE VITA P.**

*) Department of Agriculture, Food, Natural Resources and Engineering (DAFNE), University of Foggia

**) Council for Agricultural Research and Economics - Research Centre for Cereal and Industrial Crops (CREA-CI)

wheat, HTP, digital canopy model, UAV, P-spline

The present study aims to evaluate the accuracy of canopy height (CH) data derived from the digital canopy model using plot-level information in a large panel of wheat varieties, and the improvements in precision and the predictions of genotypic values produced by using a P-spline mixed model.

Multi-temporal images were collected with an unmanned aerial vehicle (UAV) platform on a field trial conducted in Italy on 354 wheat genotypes grown in replicate 10 square meters plots during 2020-21. CH data from UAV (CH_{htp}) and direct ground (CH_{field}) measurements were taken almost weekly throughout the growing season. P-spline statistical approach was used for spatial and temporal adjustment. Data fitting was evaluated both before and after the statistical correction, using coefficient of determination (R²) and root mean square error (RMSE).

Spatial trend adjustment for CH showed a significant increase in R². Comparing individual dates for CH_{field} and CH_{htp}, the R² value also increased significantly, particularly in the early stage of crop development, thanks to statistical spatial modelling, from a range of 0.26-0.82 to 0.47 to 0.83, respectively. A further increase in R² values resulted from P-spline temporal interpolation for the entire panel, ranging from 0.86 to 0.95, for CH_{htp} and CH_{field}, respectively, resulting in a RMSE values ranging from 0.04 to 0.18 meters.

This study provided evidence on the goodness of fit of time-series CH data acquired from UAV for breeding purposes.