Added value of plant height and multi-temporal modelling to improve the estimation of winter wheat, *Triticum aestivum L.*, above-ground traits based on proxy-sensing RGB cameras.

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Consumer-grade RGB cameras offer a low cost way to monitor crops but the descriptors extracted from RGB images (cover ratio, leaf color and texture) are not sufficient to fully describe the growth status of the crop. For winter wheat, *Triticum aestivum L.*, many leaves and tillers are not visible in the images.

This research aims at investigating two approaches to improve dry biomass, Leaf Area Index (LAI) and plant nitrogen estimations : (i) take advantage of a second RGB camera to obtain leaf heights through stereovision (ii) exploit reference measurements and estimations of data acquired earlier in the season to enrich the models (Michez et al., 2018).

Reference measurements consisted of LAI, above-ground dry matter (leaves and tillers separated) and nitrogen at main wheat growing stages, i.e. BBCH 20, 32 and 39. Images have been acquired in field trials (Gembloux, Belgium) thanks to two RGB cameras positioned in nadir position (1 m above the crop). Extracted traits were canopy cover, vegetation indices and statistical descriptors of leaf heights. Simple, multiple and partial least squares regressions were tested.

Considering the best models, height information improved estimation of total dry matter with RMSE decreasing from 1.31 to 0.71 t/ha, RMSE of leaf dry matter from 0.34 to 0.28 t/ha, RMSE of total nitrogen from 23.37 to 18.44 kg/ha and RMSE of LAI from 0.63 to 0.56 m^2/m^2. Adding earlier estimations and reference measurements helped to improve models for given dates.

To conclude, this study highlights the importance of height as a predictor but it is assumed that proposed models might not be robust among wheat varieties for which further trials are necessary. A methodology to develop robust predictors is being developed.

REFERENCES

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