Spatio-temporal evaluation of plant height in corn via unmanned aerial systems

Sebastian Varela,[a] Yared Assefa,[a] P. V. Vara Prasad,[a] Nahuel R. Peralta,[b]

Terry W. Griffin,[c] Ajay Sharda,[d] Allison Ferguson,[e] and

Ignacio A. Ciampittia

[a]Kansas State University, Department of Agronomy, Manhattan, Kansas, United States

[b]Monsanto Argentina, Department of Technology and Development of Corn and Sorghum, Pergamino, Argentina

[c]Kansas State University, Department of Agricultural Economics, Manhattan, Kansas, United States

[d]Kansas State University, Biological and Agricultural Engineering Department, Manhattan, Kansas, United States

[e]PrecisionHawk, Raleigh, North Carolina, United States

Keywords: unmanned aerial systems; structure from motion; corn; imagery.

Abstract. Detailed spatial and temporal data on plant growth are critical to guide crop management. Conventional methods to determine field plant traits are intensive, time-consuming, expensive, and limited to small areas. The objective of this study was to examine the integration of data collected via unmanned aerial systems (UAS) at critical corn (Zea mays L.) developmental stages for plant height and its relation to plant biomass. The main steps followed in this research were (1) workflow development for an ultrahigh resolution crop surface model (CSM) with the goal of determining plant height (CSM-estimated plant height) using data gathered from the UAS missions; (2) validation of CSM-estimated plant height with ground-truthing plant height (measured plant height); and (3) final estimation of plant biomass via integration of CSM-estimated plant height with ground-truthing stem diameter data. Results indicated a correlation between CSM-estimated plant height and ground-truthing plant height data at two weeks prior to flowering and at flowering stage, but high predictability at the later growth stage. Log–log analysis on the temporal data confirmed that these relationships are stable, presenting equal slopes for both crop stages evaluated. Concluding, data collected from low-altitude and with a low-cost sensor could be useful in estimating plant height.

Publicado originalmente en: Sebastian Varela, Yared Assefa, Vara Prasad, Nahuel R. Peralta, Terry Griffin, Ajay Sharda, Allison Ferguson, and Ignacio A. Ciampitti. 2017. Spatio-Temporal Evaluation of Plant Height in Corn via Imagery collected by Unmanned Aerial Systems (UAS). J. Appl. Remote Sens. 11(3), 036013. https://doi.org/10.1117/1.JRS.11.036013