Validation of agronomic UAV and field measurements for tomato varieties

Juan Enciso, Jinha Jung, Carlos Avila, Anjin Chang and **Junho Yeom**
Texas A&M AgriLife Research, USA

Unmanned aerial vehicles (UAV) have been recognized as excellent tools to provide real time feedback of temporal and spatial conditions found in agricultural fields throughout the growing season. UAVs have also allowed accelerating breeding programs by screening varieties or by selecting agronomic traits that confer biotic and abiotic stresses and selecting the best management practices that optimize the management of soil and water resources. The main objectives of this study were to assess the potential use of UAVs to determine crop height, canopy cover, and NDVI during the tomato growing season for eight tomato varieties; to validate tomato height obtained with a UAV; and evaluate the correlation between leaf area index and canopy cover determined with the UAV. This study was conducted at the Texas A&M AgriLife Research and Extension Center located in Weslaco, TX. The UAV was flown over a tomato trial planted with 90 plots that contained eight different tomato varieties; 3 roma (DRP8551, SV8579TE, and Tycoon) and 5 round (Mykonos, TAM-Hot, Shourouq, TAMH FlA F1, Everglade) replicated three times per row and planted in three rows. The plots of the tomato varieties Mykonos and DRP-8551 were duplicated so plants could be removed and destroyed to collect biomass data. Commitment field measurements of plant height, leaf area index, and NDVI were collected weekly (from April 27 to June 22, 2017). All the tomato varieties were healthy without diseases and the NDVI values estimated with the UAV peaked between 90 and 110 days after planting. A coefficient of determination of 0.72 was observed between canopy cover estimated with the UAV and leaf area index measured with the ceptometer. The UAV data of crop height was fitted to sigmoid curve and the coefficient of correlation was 0.9966. In addition, the calculated Fisher's paired t test statistic showed no significant difference ($P \leq 0.05$) between the estimated, the UAV and manually measured crop heights. In the future, UAV crop growth and NDVI monitoring could be improved through temporally dense data acquisition, increasing the number of ground samples and their geometric coincidence with the grids in UAV images, removal of weather effects, and other systematic errors caused from image quality and grid size.

juan.enciso@ag.tamu.edu