Enhancing the Efficiency in Data Collection in Peanut Through Whole-Plot Data Capture: The Case of Above Ground Biomass and Foliar Diseases

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Peanut is an important grain legume worldwide famed for its oil, food and feed qualities. The crop is grown on nearly 29.6 million ha with a production of 48.76 million metric tons worldwide. In Ghana, total peanut production stands at 535,685 metric tons on an area of 403,447 ha. The major constraints facing the peanut industry in Ghana is the use of old varieties with inherently low yielding potential and foliar diseases. There is therefore the need to develop new improved varieties with tolerance to foliar disease. These efforts require the development and accurately phenotyping of large populations within short time with minimal resources. This work presents the preliminary findings from the use of an UAV (DJI Mavic Pro) carrying an RGB camera to estimate biomass yield and foliar diseases in peanut with the aid of open-source software (WebODM and FieldImageR). WebODM is a photogrammetry software that can be used to generate orthomosaics, point clouds, elevation models, 3D models, measure plant traits and health, it accepts any camera and can process multispectral images from UAV. FieldImageR on the other hand is a package developed to run on the open access R software for the extraction and calculation of spectral indices. Results show a strong relationship between digitally estimated canopy area (CanArea), variable atmospheric resistance index (VARI), normalized green red difference index (NGRDI), and early leaf spot (ELS, caused by *Cercospora arachidicola* S. Hori) and late leaf spot (LLS, caused by *Cercosporidium personatum* Berk. and Curt.) AUDPC. While VARI and NGRDI had a consistently negative relationship with ELS and LLS throughout the study period from growth stage R1 (beginning flowering) to R7 (physiological maturity), CanArea had a positive relationship with ELS and LLS at R1 although not statistically significant ($p>0.05$). CanArea had a positive correlation with biomass yield at R7 ($r = 0.88$, $p<0.001$). The estimated rate curve suggested that the strength of correlation between UAV estimated parameters with ELS and LLS AUDPC increases with crop maturity. The UAV estimated parameters could therefore provide an inexpensive whole-plot data for selection for ELS and LLS tolerance and higher biomass in peanut.