Canola Yield Simulation through Digitalized Flower Number Using High-Resolution UAV-RGB Imagery

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Canola has a prominent floral signature and requires careful consideration when selecting spectral indices for yield estimation. This study evaluated several spectral indices derived from high-resolution RGB images. A small plot (2.75m x 6m) experiment was conducted at Kernen Research Farm, Saskatoon, where canola was grown under varying row spacings and seeding rates (192 plots). The canopy reflectance was imaged during the flowering period and seed yield was obtained at physiological maturity. Indices were evaluated for accuracy in quantifying canola flowers in high-resolution RGB imagery with within-canopy shadow pixels. Digitalized flower number from the peak flowering date was used to test and validate a non-linear three-parameter asymptotic regression model to simulate canola seed yield. 70 % of the data was used to develop the model, and 30 % was used to validate the model. Model performance was tested with Pseudo-R2, r, MAE, and RMSE. HFI (High-resolution Flowering Index) and MYI (Modified Yellowness Index) were able to accurately identify flowering pixels with the least amount of error pixel. The yield simulation model resulted in a pseudo-R2 value of 0.11 for the tested model and, correlation of 0.88 for validation with RMSE and MAE of 343.1 and 265.3, respectively. Our results indicate that HFI and MYI indices are a better indicator of yield potential compared to NDYI as the metric is well capable of handling within canopy shadows. Further studies are necessary to evaluate the performance of HFI and MYI vegetation indices for medium resolution-UAV and satellite imagery.