Remote Phenotyping Strategies for Sunflower Flowering Assessments at Corteva Agriscience

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Abstract

The flowering date of sunflowers is a crucial trait that significantly influences crop management practices and product placement. This trait can be measured by counting the number of days from planting until 50% of plants in a given research plot have reached flowering at R5 developmental growth stage. Traditional ground methods for data collection are labor-intensive and subjective, requiring field scientists to manually estimate and record plots with 50% flowering every 1-2 days. This approach not only consumes considerable time but also potentially overlooks valuable information related to flowering rates and duration. To address these challenges, we leveraged UAVs (Unmanned Aerial Vehicles), which allow for surveying a field in a short span of time, to model flower counts over time and predict the date when the plot reached 50% flowering. The method developed employs a deep learning model trained to detect yellow sunflower heads from UAV imagery and modeling these counts over time using a logistic function to estimate the 50% flowering date. With this method, flowering date was precisely estimated with high correlation relative to the ground measurements (r = >0.92) across experiments and locations. An increase in heritability for the remote sensing trait was also observed relative to the ground trait, and more importantly we were able to gain additional insights into flowering rates and duration. This innovative approach offers a promising avenue for enhancing the efficiency and accuracy of sunflower phenotyping.

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