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Assessment of Strawberry Disease Resistant Cultivars From Drone Imagery

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The California strawberry industry generated more than 2 billion dollars in revenue in 2020 (USDA-ERS). Strawberry breeders develop new varieties to increase productivity in the face of shifting biotic and abiotic stresses. The University of California Davis maintains a strawberry breeding program that evaluates >10,000 entries yearly to meet the demand for new improved varieties, focusing on plant productivity, fruit quality, and resistance to soil borne pathogens. One challenge to a breeding program of this scale is efficiently scoring and collecting detailed information on cultivar performance. Traits like plant size and growth rate are rarely collected. It takes a crew of 4 people 20-25 hours to score fruit count, so it is currently done once per week. Correlated traits, e.g., plant size and vigor, assessed by drone imagery could provide high-quality information and replace labor intensive assessments of phenotypic traits and yield. In 2022 we deployed drones to generate research grade imagery of nearly 10,000 entries at Wolfskill Experimental Orchard in Winters, CA and another 3,000 entries under induced disease pressure to determine the best predictors of productivity and disease severity from drone imagery. We applied image analytics tools developed by HIPHEN to extract ground coverage, plant height, biovolume and a range of visual indices from multiple sensors to assess cultivar performance. The extracted traits were then used as independent variables to predict either yield or visual disease severity. We report our initial findings, examine the successes and learnings, and propose solutions to ongoing challenges in strawberry breeding.