

High-throughput field phenotyping for important crop breeding traits

Sameer Joshi¹

Joshua Koh¹, Bikram Banerjee¹, Babu Pandey¹, Garry Rosewarne¹ and Surya Kant¹

¹ Agriculture Victoria, Grains Innovation Park, 110 Natimuk Road, Horsham, Vic 3400, Australia

Precise and rapid phenotyping is critical to speed-up breeding for improved varieties of field crops. Non-destructive phenotyping techniques are preferred over destructive methods as they allow for repeated measurements and more informative data capture in a cost-effective manner. Sensor and camera-based equipment can provide non-destructive, precise and high-throughput measurements of traits for crop breeding. Here, we describe how we have deployed customized aerial imagery platforms and infrastructure. We show examples of application of phenotyping platforms to measure traits such as nutrient and water use efficiency, disease resistance, and screening large reference population to support molecular and genomic breeding and to take informed breeding decisions for the development of improved crop varieties. We also describe how we have developed workflows for image processing and analysis to extract data at the plot level from our aerial imaging platforms, which are equipped with a range of multispectral and thermal sensors, and high-resolution cameras. We currently measure a range of agronomic and growth traits including emergence count, plant height, phenology, canopy coverage, biomass, growth rate and plant health. Our aerial imaging capabilities enable high-throughput phenotyping of large-scale field experiments across the entire growth cycle for a range of crop species including wheat, canola, safflower, field pea and lentil with precision, repeatability, time and cost efficiency compared to conventional phenotyping methods. Results will also be presented for the application of a multispectral camera that gives normalized difference vegetation index to correlate with disease scores for the assessment of bacterial blight in breeding trials.