Applications of Unmanned Aircraft System for Genomic Selection of Drought Tolerance in Forages

Junping Wang[1], Pieter Badenhorst[1], Andrew Phelan[1], Luke Pembleton[2], Noel Cogan[2]

[1] Agriculture Victoria, DEDJTR, Hamilton Centre, 915 Mount Napier Road, Hamilton, Victoria 3300, Australia
[2] Agriculture Victoria, DEDJTR, AgriBio, the Centre for AgriBioscience, 5 Ring Road, Bundoora, Victoria 3083, Australia,
Correspondence to: junping.wang@ecodev.vic.gov.au

Keywords: Genomic selection, drought tolerance, ryegrass

Abstract:
Drought is a serious challenge to global agriculture and food security. Genomic selection in in forage plant species have been proposed as a molecular breeding tool for increasing genetic gain efficiently in particular for quantitative traits such as yield and drought tolerance (Hayes et al. 2013). High throughput and accurate phenotyping will enable reliability and accuracy of prediction and efficiency of selection. We applied unmanned aircraft systems for drought tolerance phenotyping of perennial ryegrasses aiming to develop genomic prediction equations. A spaced plant field trial of perennial ryegrass was established in 2016. The drought treatment was applied through rainout-shelter and the control plots under natural rainfall (Figure 1). Weekly aerial images were taken using 3DR Solo Quadcopter with Parrot SEQUOIA multispectral sensor. The normalized difference vegetation index (NDVI) values for individual plant were acquired by analysis the multispectral images through Pix4D and QGIS. Genomic selection prediction equations have been developed for drought tolerance and are being implemented through rapid genomic sub-selection. The performance of the next generation seeds will be tested. The subsets of selections have the potential to be developed further and released as an advanced version of the cultivar for drought tolerance and commercialized to realize the genetic gain.

Figure 1. Rainout-shelter for drought tolerance screening

References:

Hayes B, Cogan NOI, Pembleton L, Goddard M, Wang J, Spangenberg G, Forster JW (2013) Prospects for genomic selection in forage plant species. Plant Breeding, 132:133-143