In-season yield prediction using VARIwise

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In-season yield prediction supports improved agronomic management and planning for crop sales and insurance contracts. Yield is currently often estimated using rules of thumb and manual boll counts. Data analytics approaches have been developed using site- and season-specific multi-spectral satellite imagery-based correlations that require significant datasets for wider scale transferability. An alternative approach is to forecast yield using known soil-plant-atmosphere interactions in crop production models and calibrated using available field data. USQ has developed software 'VARIwise' to provide yield prediction throughout the season combining these models with: (i) plant parameters extracted from UAV imagery using image analysis; (ii) online soil and weather data; and (iii) on-farm management information.

In the 2017/18 and 2018/19 seasons, VARIwise was evaluated at one cotton site in Goondiwindi and 16 sites in Griffith. Management zones in the field monitored using the UAV were identified from vegetation index surveys, yield maps or satellite images. Phantom 4 UAV imagery was collected monthly at each site between January and picking for calibrating the crop model. The sites had varying levels of fruit removal, hail damage and heat stress.

In the 2017/18 Griffith trial, the percentage yield prediction errors were 10.2% in January, 6.0% in February, 2.5% in March, and 0.5% at picking, and in the 2018/19 Griffith trial the errors were 18.8% in January, 4.9% in February, 9.5% in March, and 10.1% at picking. In the 2018/19 Goondiwindi trial, the yield prediction percentage errors were 8.7% in February, 5.9% in March, 7.1% in April and 2.6% in May. The prediction errors at Griffith were higher in the 2018/19 season than the 2017/18 season because the sites experienced hail and heat stress that are not currently represented within the VARIwise crop model. The yield predictor will be evaluated in 2019/20 to improve performance under insect and hail damage.