

How Can We Demonstrate the Economic Value of Precision Agriculture (PA) Practices to New Zealand Agriculture Service Providers and Arable Farmers?



G. Jiang*, I. Yule, M. Grafton, I. Draganova, A. Holmes
 * Massey University, Palmerston North, New Zealand
 Email: g.jiang@massey.ac.nz



Background of Study

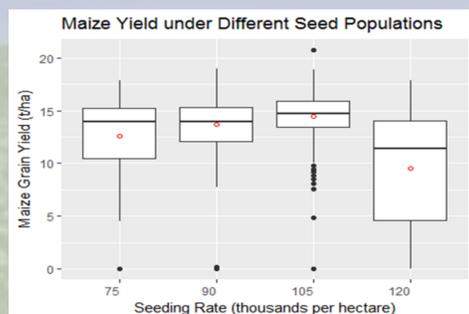
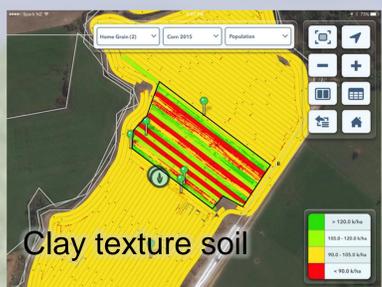
- The amount of data collected has become a major challenge to the uptake of PA practices in New Zealand.
 - There is a lack of clear value propositions around some PA practices, e.g. variable rate seeding (VRS).
 - The importance of calibrating yield monitors, collecting yield data and mapping results has not been realised by farmers.
- The goal of the study is to provide economic evidence through yield data mining to encourage the adoption of PA.

Method

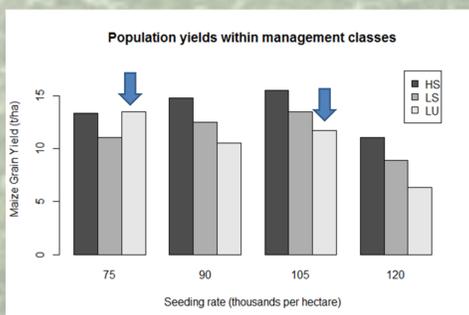
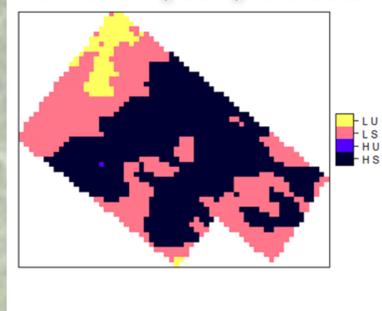
A number of preliminary trials were conducted using yield data from a number of crop types collected on individual fields, which provided a basis for spatial data analysis using ArcGIS, R, Farm Works.

Trial 1 Maize Seed Population Trial

- Seed cost is a major expense for growing maize in New Zealand, the cost is around \$6 per thousand seeds.
- VRS technique has the potential to save seed costs while maintaining yield productivity.
- Seed density can be altered according to management classes based on historical yield patterns.
- In some cases there were no significant differences ($p > 0.05$) in yield between planting densities, which supports the hypothesis that seeding rates can be altered to save cost.

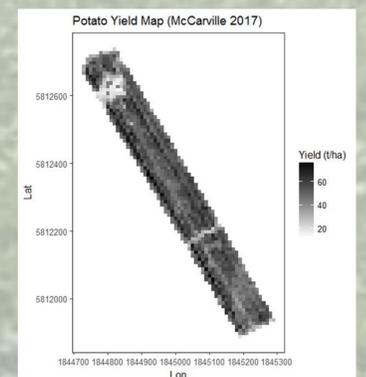
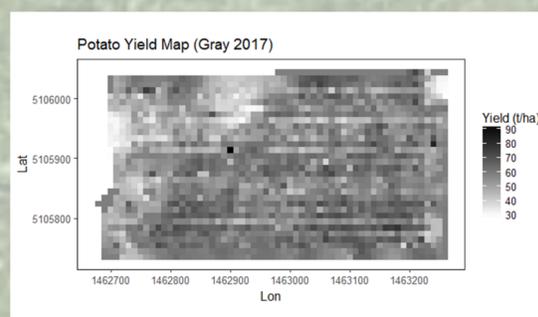


MZ from 4-year yield data

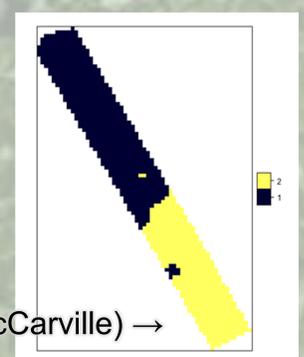


Trial 4 Potato Yield, Tuber Size Variability

- Tubers sized 45 – 80 mm are required to meet a certain NZ fresh market standard.
- Tuber samples were collected in 1.5 m strips, 50 m apart in Gray and McCarville. Soil samples were collected at each location.
- Potatoes were harvested in 2017 and yield was recorded.
- Yield data and tuber size data were interpolated into 10 m grid maps, overlaid and clustered.
- In Gray, yield was significantly lower ($p < 0.05$) in Cluster 1; while soil pH, soil nitrogen and soil calcium were lower in Cluster 1 and Cluster 2. Cluster 1 and a part of Cluster 2 did not receive centre pivot irrigation (CPI).
- In McCarville, tuber size was significantly lower in Cluster 1; Stem Counts were significantly higher in Cluster 1; Soil CEC was significantly lower in Cluster 1.



Clusters (Gray) ↑



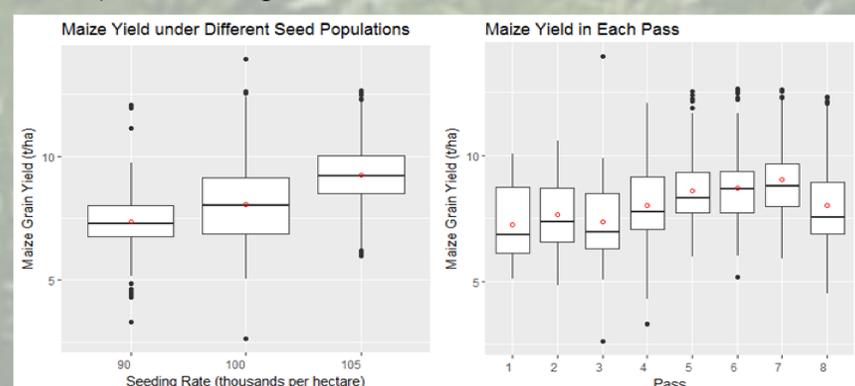
Clusters (McCarville) →

Trial 2 Maize Hybrid Seeding Trial

- Volcanic loam, 1.6 ha planted with 2 hybrids at 3 different seed rates, harvested on 17/8/2017.
- At the same seeding rate, one hybrid yielded significantly higher ($p < 0.05$) than the other. For each hybrid, there was no significant difference in yields between seed rates

Trial 3 Maize VRS Trial

- Loam, 1.3 ha planted at 3 different seed rates.
- Pass 1, 3, 5, 7 planted the reference rate (100,000), and Pass 2, 4, 6, 8 planted VRS (90,000 and 105,000) prescribed based on 2015 grain yield.
- VRS mostly produced higher yield than the reference (except Pass 8) while using less seeds.



Conclusion

- Many crop farmers have collected and recorded yield data. Very few have clear ideas as to how collecting accurate data from calibrated yield monitors can improve their business management.
- Yield data can be used to alter seeding density spatially to reduce cost.
- Yield data can be used to investigate soil fertility and texture in areas where yields are quite different, from which suitable hybrids and varieties may be seeded to reflect soil types.
- There is no standard protocol for prescribing VRS and due to lack of calibration of monitors and variable accuracy of GPS systems, no consistency of historical yield data.
- Most trials were conducted in a small part of the field (1 to 2 ha) with small soil variations. A large scale implementation of VRS has not yet been studied.
- Potato yield might be associated with the efficiency of CPI in Gray. Tuber size might be associated with planting density in McCarville.

How can we demonstrate the economic value of precision agriculture (PA) practices to New Zealand agriculture service providers and arable farmers?

Jiang G

2017-10-16