KOO WEE RUP DEMONSTRATION SITE CASE STUDY
MAY 2020

Soil Wealth NURTURING CROPS | Integrated Crop Protection PROTECTING CROPS

PRECISION AG PAYS OFF IN BUMPER CELERY CROP

KEY MESSAGES

- ✔ **Improved uniformity of nutrient availability through variable rate spreading**
- ✔ **Reduced soilborne disease risk and severity**
- ✔ **Faster in-field monitoring of plant nutrient uptake to inform decisions**
- ✔ **Digital insect scout monitored crops around the clock as a 'back up'**
- ✔ **More consistent marketable yield from treated areas**

OVERVIEW

Schreurs & Sons and the Soil Wealth ICP team have partnered to explore the application of precision agriculture in celery, leek and baby leaf production systems. The demonstration site is located at Adam Schreurs' Cora Lynn farm, about 80km south-east of Melbourne, Victoria.

Over the past two years Adam and the team have aimed to improve nutrition, irrigation and drainage management, and insect pest and beneficial monitoring as a basis for soil and crop health. To achieve this, we've used technology like EM38 mapping, gridded soil sampling, variable rate fertiliser spreading, remote monitoring of insect pests and beneficial identification traps with cameras, as well as drones.

This case study, developed by Adam Schreurs (Schreurs & Sons), Stuart Grigg (Stuart Grigg Ag-Hort Consulting) and Carl Larsen (RMCG), captures the key demo site findings and lessons from 2018 to 2020.

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IMPROVED UNIFORMITY OF NUTRIENT AVAILABILITY THROUGH VARIABLE RATE SPREADING

Variable rate allows fertiliser to be applied at different rates depending on the changes in soil chemistry across the block. The aim is to achieve a more consistent and high-quality cash crop through more precise application of nutrients – where the soil and crop needs it.

Large areas of the trial site have improved uniformity of nutrient availability due to the gridded soil sampling and variable rate fertiliser spreading. The gridded soil sampling results show that large areas of the trial site have shown the following.

- Improved from lower pH (5.2-5.7 [CaCl2]) to higher (5.8-6.3 [CaCl2])
- More consistent K (100-249mg/kg)
- More consistent P (71-430mg/kg)
- More consistent Mg (200-399mg/kg)
- Lower average Na (50-99mg/kg) down from 100-199mg/kg.

The output of the gridded sampling for two key parameters, pH and K, and the changes from 2018 to 2019 are shown in Figure 1 below and Figure 2 on the following page. This information helped Adam revise and adapt his nutrition program for the site.

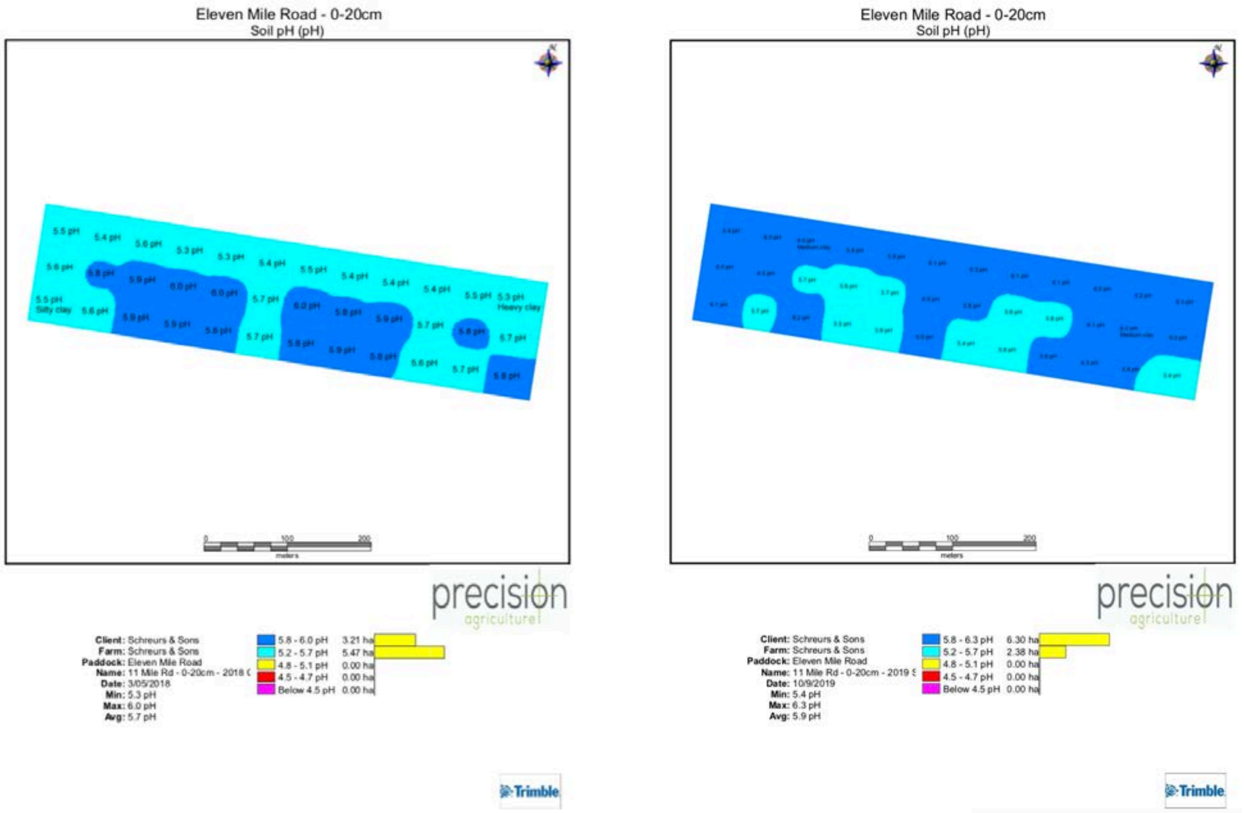

Figure 1: Changes in variability of pH at 0-20cm from 2018 (left) to 2019 (right)

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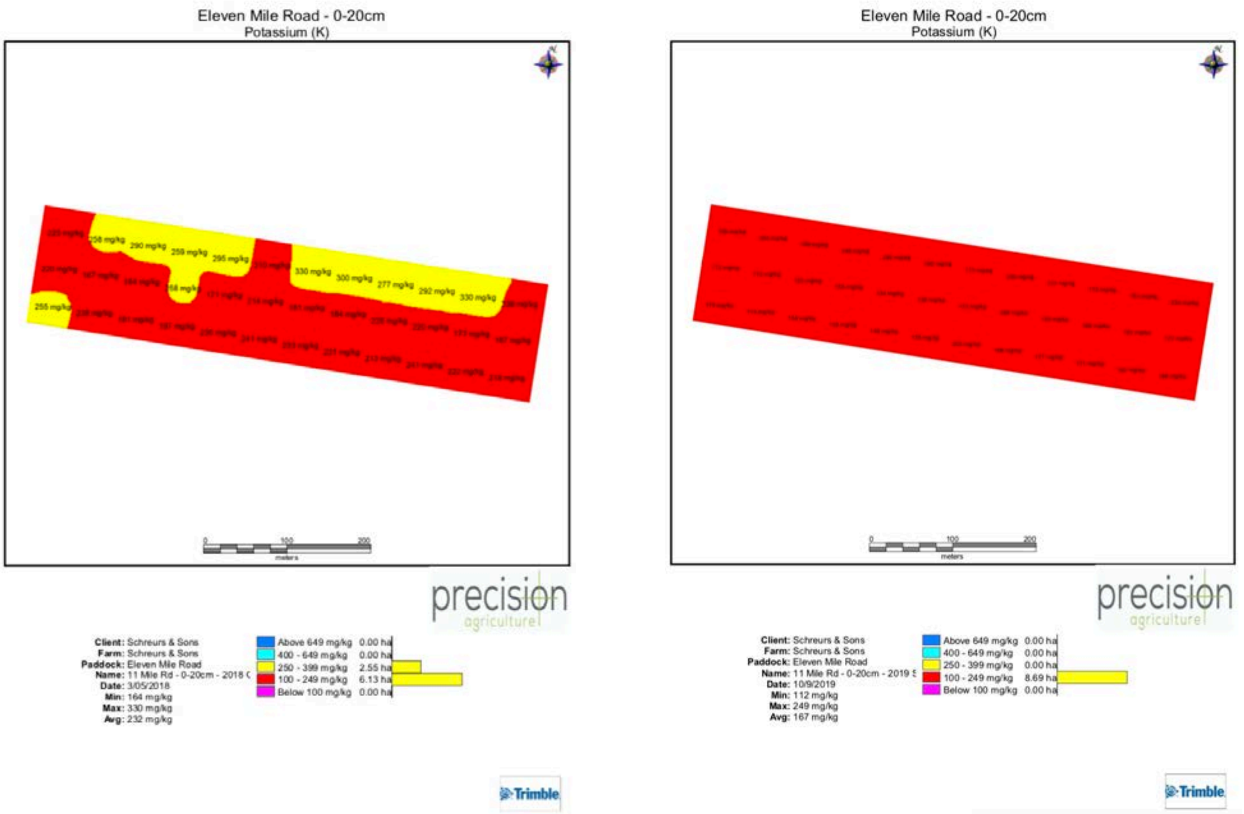

Figure 2: Changes in variability of potassium at 0-20cm from 2018 (left) to 2019

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The spreader maps show a change in application rates for most inputs, with a shift to more consistency over time and less variability in minimum and maximum across the trial site.

Figure 3 shows SOP (sulfate of potash) rates varied from 0-500kg/ha in 2018 (total amount of 2,061kg) with a high degree of variability in the north. This narrowed to range between 250-700kg/ha in 2019 (total amount of 1,163kg).

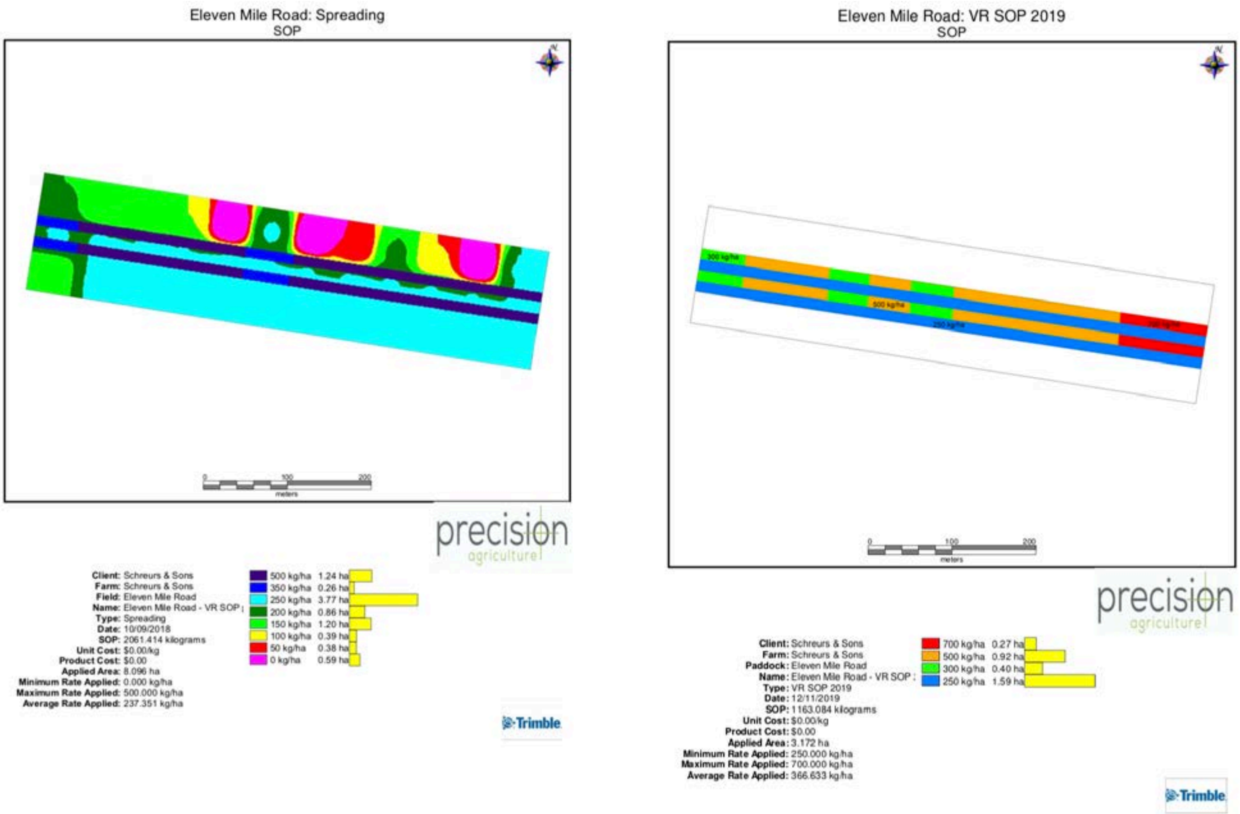

Figure 3: Variable rate application rates for SOP pass 1 in 2018 (left) and 2019

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Figure 4 shows lime rates varied from 0kg/ha in areas where there was optimal pH to over 11kg/ha in problematic spots in the north of the block in 2018. Lime was not applied in 2019 to those areas that received higher rates of lime in 2018, indicating some problem areas had been ameliorated. However, there were also areas that did not receive lime in 2018 that received higher rates in 2019 to manage the slight decrease in pH.

This is a huge difference in inputs – and costs – for a relatively small block for Adam.

"The trial has turned the worst performing part of my farm into the best performing part of my farm. It's a massive turnaround in two years," he said.

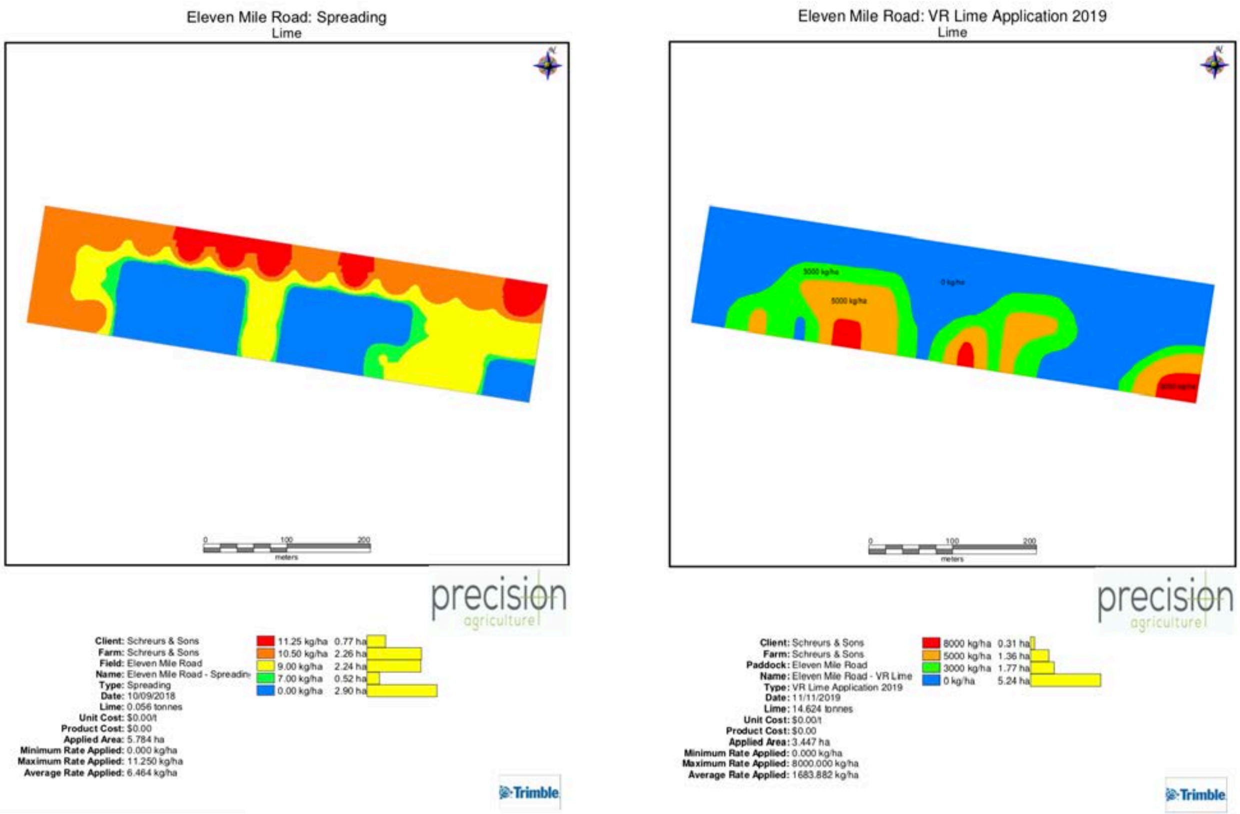

Figure 4: Variable rate application rates for lime in 2018 (left) and 2019 (right)

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In addition, there have also been improvements in soil constraints such as soil texture, salinity and/or water held in the soil profile (indication of drainage) as measured by the EM38 mapping (blue and green areas). Figure 5 shows a reduction in the red and orange problem areas in the north and south-west of the trial site from 0-75cm that have historically caused reduced yields due to waterlogging or other soil structure problems (e.g. compaction).

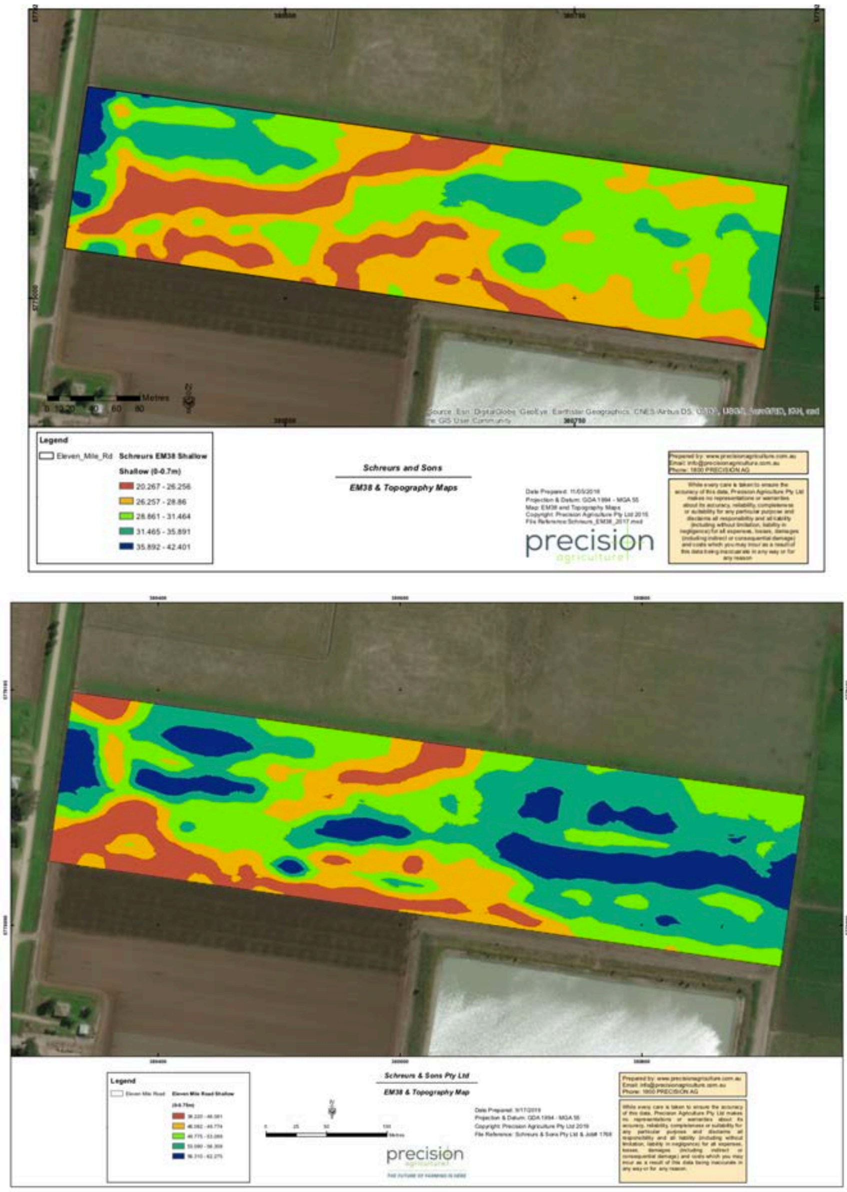

Figure 5: Changes in EM38 from 0-75cm from 2018 (top) to 2019 (bottom)

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REDUCED SOILBORNE DISEASE RISK AND SEVERITY

Soilborne diseases can cause significant damage and crop losses to vegetable growers. The most important, and potentially destructive, pathogens of celery are *Sclerotinia* spp., *Pythium* spp. and *Rhizoctonia* spp.

There has been a reduction in soilborne disease risk and severity over time at the site, which has been more pronounced in the trial area compared to the control. The most significant reductions were in *Pythium* spp. (to moderate levels) and *Rhizoctonia* spp. (low levels) in the trial area. This may be due to the precision agriculture activities at the trial site as well as other factors such as soil moisture, temperature and variation in planting times.

Table 1 illustrates the changes in soilborne pathogen concentrations from 2018 to 2019. In reference to the 'Change since 2018 (Trial and Control)' columns, the value denotes the difference between 2019 and 2018 values. For example, the *R. solani* AG2.1 concentration of the trial in 2018 was 101pgDNA/g Sample which has decreased by 97 pgDNA/g Sample in 2019.

Pathogen	Trial change since 2018	Trial 2019	Control change since 2018	Control 2019
Pythium Clade F (multiple species) (pgDNA/g Sample*)	+9	609	-198	1047
Pythium Clade I (multiple species) (pgDNA/g Sample*)	-128	170	-93	251
Pythium sulcatum (kDNA copies/g Sample*)	+3	7	+2	5
Pythium violae (kDNA copies/g Sample*)	0	0	0	0
R. solani AG2.1 (pgDNA/g Sample*)	-97	4	+31	34
R. solani AG2.2 (pgDNA/g Sample*)	0	0	0	0
R. solani AG3 (pgDNA/g Sample*)	0	0	0	0
R. solani AG4 (pgDNA/g Sample*)	0	0	0	0
R. solani AG8 (pgDNA/g Sample*)	0	0	0	0
S. sclerotiorum (kDNA copies/g Sample*)	-3	0	-11	9

Key: Low | Low-moderate | Moderate | Moderate-high | High

Table 1: Pathogen risk at the trial and control areas in 2019 and change since 2018

*Note: Tests that were previously reported in 'copies / g sample' units in 2018 have been changed to 'kDNA copies / g sample' in 2019, and have therefore been converted and standardised for comparison between years.

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FASTER IN-FIELD MONITORING OF PLANT NUTRIENT UPTAKE TO INFORM DECISIONS

More precise nutrition and drainage management corresponded to improvements and consistency in the celery nutrient uptake during the summer growing season.

A comparison of field (Horiba hand-held meters) and lab (Hortus) sap testing showed the value in faster in-field monitoring across a number of sample points in the trial area.

Good correlation was found between field and lab testing with Ca, Na and K with some disparity in N (see Figure 6). Most of the key elements were within the ideal plant tissue ranges from early maturity, late maturity and at harvest, with the exception of the N lab test.

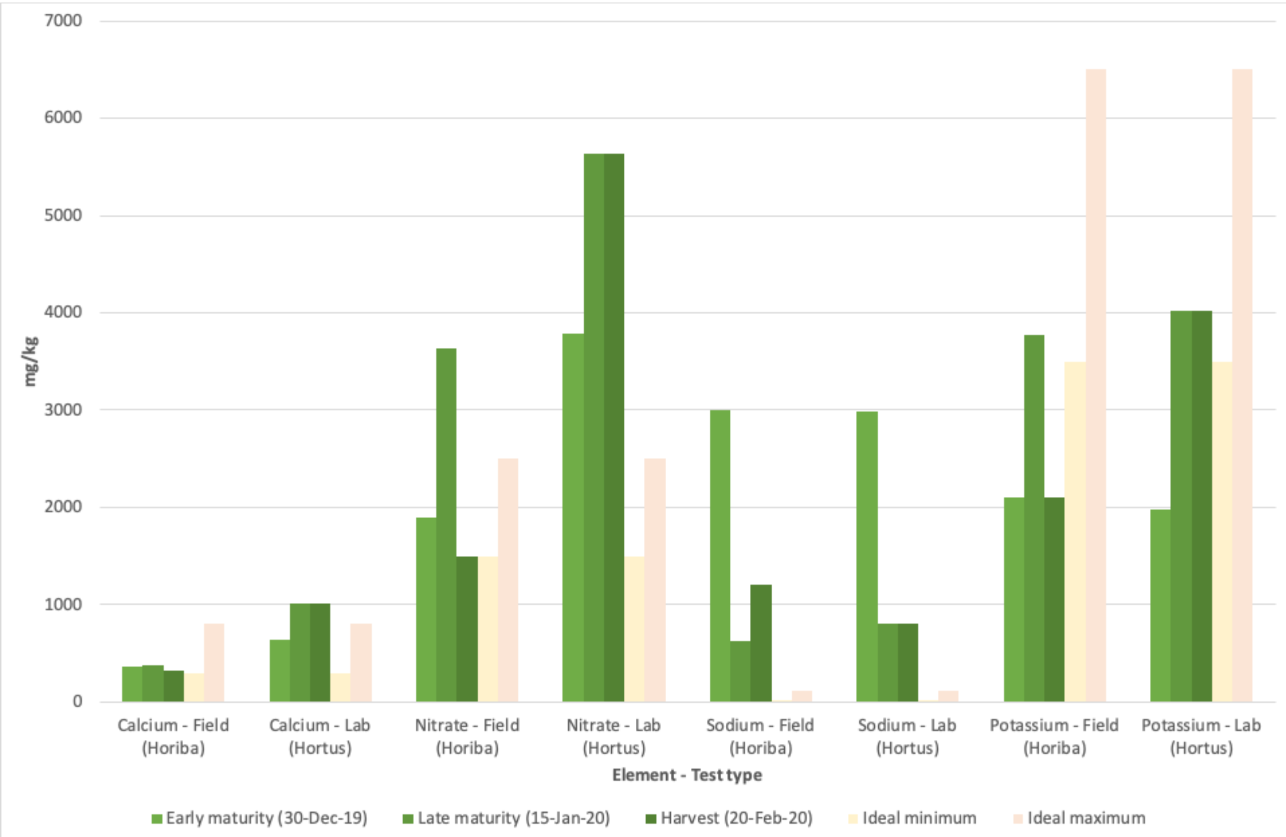

Figure 6: Comparison of field (Horiba) and lab (Hortus) sap testing during early maturity, late maturity and harvest

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DIGITAL INSECT SCOUT MONITORED CROPS AROUND THE CLOCK

From October to December 2019, the project team more actively used and calibrated the remote monitoring insect trap with the assistance of Paul Horne and Jessica Page from IPM Technologies.

One of the benefits of the remote monitoring was the early detection of relative pest pressure and indication of the reliability of flights (timing and duration), which has been changing in the region over the years. This provided time saving as well as piece of mind knowing there was a 'back-up' system in place. However, it was important to have conventional scouting to correctly identify pest species and inform control options at the farm. For example, Figure 7 shows relatively high moth pressure detected through the online platform that alerted the team, however further investigation showed these weren't heliothis (*Helicoverpa armigera, H. punctigera*) so there was little risk posed to the celery crop.

The team also attempted to correctly identify pest species on the online platform, in particular heliothis (*Helicoverpa armigera, H. punctigera*), cutworm and vegetable looper. This assisted to 'train' the algorithm to correctly identify our priority species, as the technology is being adapted from orchard cropping systems in Europe where the pests are very different. While this was useful, some of the challenges included the following.

• A cool, wet spring leading to relatively low pest pressure with some heliothis and flies but minimal crop damage (good for Adam!)

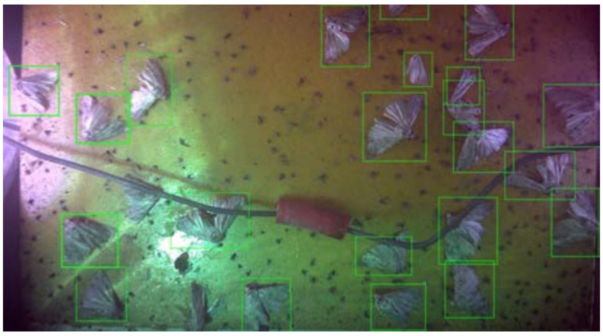

Figure 7: Image showing moth detections in the covered trap in November 2019

• Relatively high populations of beneficial insects such as green/brown lacewings and ladybirds (excellent for the IPM program at the site)

• Difficulty in detecting important anatomical parts of the insects through the photos due to the position of the plate and camera

• Access to the traps in later crop maturity as it was not positioned along normal scouting routes.

A small number of tiny caterpillars were found in late November and a spray was recommended across the trial site. While Figure 8 shows late November was when the pest population was declining from its peak in the middle of the month, importantly it was the species type that informed management decisions.

Some of the remaining questions the team will investigate over the coming year include – would we use a different control measure? Perhaps the same control earlier or at a different time? Are there any gaps in the information the unit provides?

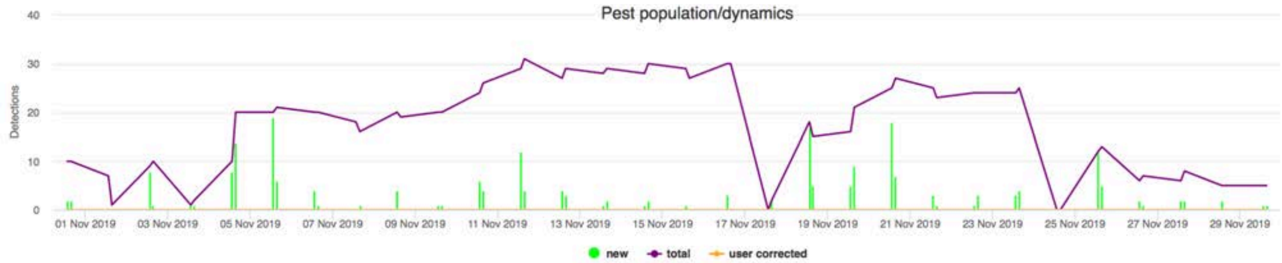

Figure 8: Pest population and dynamics automatically detected through the online platform in November 2019

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MORE CONSISTENT MARKETABLE YIELD FROM TREATED AREAS

Marketable yield is what drives farm profitability and returns to Adam's business.

"Last year's crop [2019] was the best quality we'd had but there was still so much variation in crop growth and head weight from row to row and across the farm," he said.

The results show a more consistent marketable yield from the trial area over the past two years (see Figure 9). Yield assessment data showed a significant improvement in consistency of the 2020 crop, ranging in variability from 4-12%, compared to the 2019 crop, ranging from 45-53% across multiple samples within the trial block.

"The harvest from the demo site this year [2020] was so uniform. It was really noticeable when it was coming off the block. It was a fantastic result – it beat the best crop off the farm," Adam added.

This meant easier grading and packing of celery by staff and ability to supply customers with a product that better met their specifications.

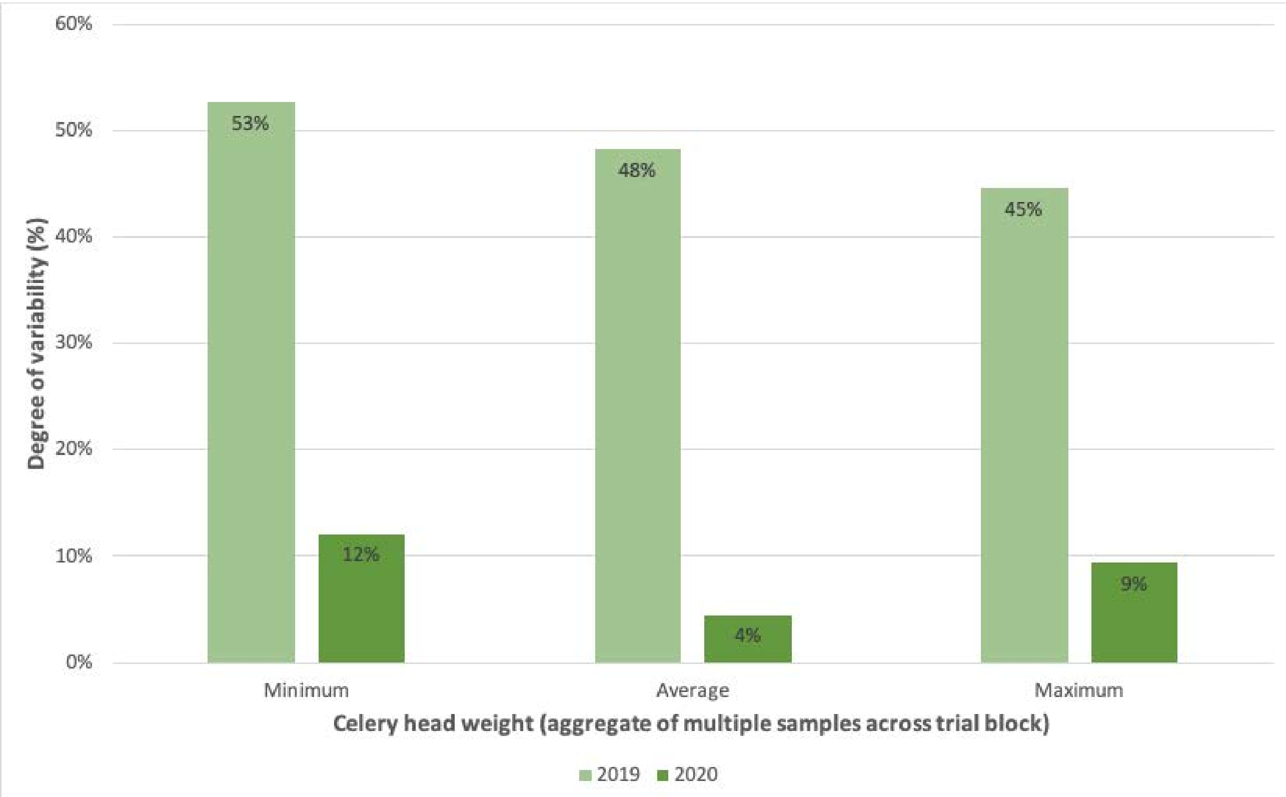

Figure 9: Degree of variability in celery head weight between 2019 and 2020 harvest in the trial area

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More information

Head to our website (soilwealth.com.au/demo-sites/koo-wee-rup-vic/), or keep an eye on the Facebook page for updates and to track progress (facebook.com/SoilWealthICPKooWeeRup/).

Acknowledgements

Thanks to our project partners Schreurs & Sons, Stuart Grigg Ag-Hort Consulting, Brown's Fertilisers, Precision Agriculture, OneHarvest and Metos – Australia & NZ.

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