SA Drought Hub Technical Report

DN4_24_03 Easy VRT – decision support taking growers from entry level to expert

PROJECT LEAD: Mallee Sustainable Farming

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PROJECT SUMMARY

Mallee soils are notoriously variable ranging from gutless sands to heavy constrained flats creating a complex challenge when it comes to optimising fertiliser inputs and managing crop performance. This variability impacts both the efficiency and profitability of nutrient use, and while it has traditionally been seen as a barrier, it is now recognised as an opportunity: where targeted Variable Rate Technology (VRT) can drive more efficient resource use, better returns on investment (ROI), and greater resilience.

This 2024–2025 project builds on previous years of engagement across Murray Plains, Waikerie, and Lameroo, continuing to support growers as they progress in their VRT journey. Earlier phases of the project demonstrated how zonal soil sampling and targeted strip trials could uncover significant differences in nutrient availability and fertiliser response. For example, zonal approaches identified phosphorus needs varying from >20 kg/ha in some areas to just 5–6 kg/ha in others optimising inputs without increasing overall costs but improving profitability.

Observations and results from two focus farms from each area, and several additional paddocks located closely, confirmed the value of:

1. Creating zones for targeted soil sampling and analysis,
2. Using soil analysis to reveal nutrient levels, constraints and fertiliser requirements, and
3. Adjusting fertiliser inputs to zone-specific needs (off processes 1 & 2), improving partial gross margins compared to flat fertiliser rates.

This year's work deepened that engagement. Farmers selected paddocks of interest, mapped zones using NDVI and satellite data, and applied variable fertiliser trial strips (±50% of standard practice). With support from technical specialists, growers discussed crop responses, PAW constraints, and in-season nutrient strategies even through a challenging season. In many cases, yield variation due to soil water-holding capacity rather than nutrient levels validated the importance of understanding both opportunity and risk profiles within each zone.

Another focus of this project stage was the development of the *Easy VRT* decision support tool an intuitive, repeatable platform delivered through Agri Solve. This tool allows growers to return each season to plan and expand VRT into new paddocks. It provides simple prompts for defining zones, integrates weather and NDVI overlays, and includes calculators for nitrogen and phosphorus inputs. The platform also incorporates local soil pit data and season-specific risk matrices to guide fertiliser decisions by zone and rainfall outlook, providing a bridge between real-world experience and digital decision support.

This returnable platform is key to adoption. It empowers growers to revisit and refine their approach annually, not just implement one-off trials. Farmers can overlay yield maps, analyse soil test data, and manage paddock-specific nutrition plans all while being supported by their grower groups, MSF's community of practice, podcasts, workshops, and technical advisors.

With each season, farmer confidence in VRT continues to grow. Despite dry conditions, participation remained high and engagement deepened. Producers are becoming more confident in their data, more willing to trial variable rates, and more comfortable integrating digital tools into practical decision-making. They're beginning to see VRT not as a complex or expensive concept, but as a logical step in managing input costs, optimising yields, and building resilience.

By developing both on-ground support and a scalable digital platform, this project has created a pathway for both early adopters and cautious observers. It is laying the foundation for widespread adoption of VRT practices across the SA Mallee practices that are evidence-based, locally tailored, and farmer-led.

EXECUTIVE SUMMARY

Fertiliser inputs are among the highest costs for Mallee farmers, particularly in low rainfall seasons. Combined with the highly variable soils that characterise the South Australian Mallee, managing inputs efficiently is both a challenge and a major opportunity. This project continues efforts from 2022 and 2023 to help farmers transition from basic awareness to confident adoption of Variable Rate Technology (VRT) as a practical tool to optimise fertiliser inputs and improve profitability.

The project focused on three core Mallee regions Murray Plains, Waikerie and Lameroo/Pinnaroo building on early demonstrations and trial strip work. Farmers were supported to implement VRT by using NDVI imagery and EM38 maps to define management zones, followed by targeted soil sampling, analysis, and variable rate fertiliser strip trials. The trials involved adjusting nutrient applications by ±50% of grower practice, which helped growers assess crop responses across soil types and zones. Findings from the 2023 season confirmed the value of zone-based sampling, with nitrogen variability exceeding 100 kg/ha between zones, and phosphorus recommendations ranging from >20 kg/ha to replacement-only rates, depending on crop performance and nutrient history.

In 2024, the project continued to help growers manage seasonal challenges while beginning the development of the *Easy VRT* decision support platform. This new online tool will guide growers step-by-step through the VRT process from zoning paddocks using local NDVI and satellite data, to accessing local soil and rainfall information, and applying nutrient calculators based on default or farmer-supplied soil test results. By early 2025, the platform will be available to participating growers, providing a consistent, scalable, and user-friendly pathway to broader VRT adoption.

The project has shown that VRT strip trials can significantly improve partial gross margins (PGM), with benefits of $20–$50/ha observed through more accurate nutrient placement and reduced wastage. Focus farms and supporting data demonstrate that VRT is not just a high-tech tool, but a practical solution to managing Mallee soil variability. Farmers now recognise that zones need to be treated differently feeding better-performing soils to their yield potential and addressing constraints in poorer zones before reducing inputs.

Farmers, advisors, and fertiliser retailers will benefit from the project's outcomes. The hands-on approach combined with the development of a robust digital tool has helped bridge the technical gap in an industry that currently lacks widespread VRT expertise. The adoption of practices can begin immediately, particularly with soil zoning and strip trials, while broader implementation through the *Easy VRT* platform will roll out in 2025.

The community of practice built around the project through crop walks, podcasts, workshops, and regular advisor engagement continues to support both learning and peer-

to-peer adoption. Farmers are asking better questions, making more informed fertiliser decisions, and seeing the benefits of applying inputs based on data rather than uniform rates.

For further support and adoption guidance, contact:

- **Tanja Morgan – Mallee Sustainable Farming** (Project coordination, extension support)
- **Dr. Sean Mason – Agronomy Solutions** (Soil testing, nutrient strategies)
- **Chris McDonough & Peter Treloar** (Technical advice on mapping, trial setup, paddock planning)

This project demonstrates that with the right tools, guidance and any equipment on hand, VRT can become a practical, profitable and widely adopted part of resilient farming in the South Australian Mallee.

PROJECT BACKGROUND AND OBJECTIVES

Fertiliser inputs are one of the highest variable costs in crop production, and in the low-rainfall, variable-soil environment of the SA Mallee, managing those inputs effectively is essential to reduce risk and maximise return on investment (ROI). Mallee soils vary significantly across paddocks in both nutrient availability and productivity, meaning that flat-rate fertiliser programs often underperform either underfeeding productive zones or wasting inputs on constrained soils.

Previous project work (2022–2023) across three grower groups Murray Plains, Waikerie (Lowbank), and Lameroo demonstrated the value of using soil zone mapping, targeted soil sampling, and strip trials to inform fertiliser decisions. These efforts improved growers' understanding of how to manage variability, build confidence in Variable Rate Technology (VRT), and fostered a strong community of practice. Farmers who participated in on-farm trials, crop walks, and planning sessions began to see measurable improvements in paddock performance and nutrient use efficiency, even in challenging seasons.

Despite this progress, the complexity and lack of easy-to-use tools remain a major barrier to widespread adoption. Growers and advisors need practical, streamlined digital support to guide them through the VRT process from zoning to fertiliser decisions based on local soil and seasonal context. This next phase of work addresses that gap.

The objective of the *Easy VRT* project is to develop a simple, accessible online decision support tool to guide farmers through the process of zoning paddocks and making zone-specific fertiliser decisions. The tool is being designed for entry-level users and based on practical rules of thumb, using widely available datasets such as NDVI, satellite imagery, and

local soil information. It will be delivered through the Agri Solve platform (https://agrisolve.com.au), a spatial mapping tool already used in other industry programs.

Key Tasks and Features Include:

1. **Decision Tree Tool:**
   An online decision support system that guides users through zone creation, soil interpretation, and fertiliser decision-making.
2. **Zone Mapping:**
   Integration with Agri Solve to enable interactive map drawing and definition of five base zones: Gutless Sand, Better Sand, Good Loam, Heavy Constrained, and Shallow Stone.
3. **Zone Management Support:**
   Embedded guidelines to highlight the implications of each zone type, using decision support matrices combining soil type, rainfall pentiles, and seasonal goals.
4. **Nutrient Guidelines:**
   Fertiliser rules of thumb tailored to each soil zone, accounting for responsiveness, season timing, and plant available water.
5. **Financial Integration:**
   Farmers can input their fertiliser budgets, with the tool redistributing inputs across zones for more efficient use of resources.
6. **Farmer Group Collaboration:**
   Ongoing collaboration with existing grower groups to test the tool against real-world scenarios, run strip trials, and build comfort with the platform. This has included pre-season meetings to review previous harvests, plan trial strips, and conduct targeted soil testing, as well as in-season crop walks and post-emergence assessments.
7. **Expert VRT Expansion:**
   The tool will continue to evolve with additional capabilities, including real-time weather and soil moisture integration, EM38 zone management overlays, tissue testing inputs, and protein mapping. Integration with the Mallee Calculator and Agri Solve will enhance nutrient recommendations.

The success of this project to date has been driven by strong on-ground support from Sean Mason, Peter Treloar, and Chris McDonough, alongside MSF's role in connecting groups and facilitating learning. These collaborative efforts are critical to ensuring that VRT becomes an accessible, scalable, and farmer-driven solution across the SA Mallee.

To support the ongoing adoption of VRT, MSF continues to engage closely with the three core grower groups Murray Plains, Waikerie, and Lameroo through regular on-farm meetings, crop walks, and planning sessions. These meetings help farmers maintain momentum with their trial strips and provide feedback critical to shaping the Easy VRT

platform. In parallel, MSF and project partners are delivering digital seasonal updates through podcasts, social media, livestreams, and community of practice networks.

This multi-channel extension approach ensures that information reaches a broad farming audience in formats that suit their preferences and schedules. By combining digital tools with consistent in-person support, the project is creating a strong foundation for widespread, confident adoption of VRT practices across the SA Mallee.

METHODOLOGY / LOCATION

Project work focused on two growers per region which had setup fertiliser treatments in 2023 and were willing to keep these going for the 2024 season.
Assessment of 2023 grain yield data along the strips for each treatment meant that we could target 2024 pre sowing soil sampling activities and ensuring results to reflect soil type change and influence on crop responses/non-responses from the 2023 season.
Crop performance within each treatment for each paddock was monitored in season through NDVI and via harvest grain yields assessed through grain yield maps and analysis by Pete Treloar.

Summary of focus paddock details can be found in table 1.

Table 1: 2024 project focus paddocks with an emphasis on replicating permanent strips set up in 2023.

Growers Name	Region	Paddock location	2023 crop	2023 treatments	2024 Crop	2024 treatments
Scott and Zoe Starkey	Murray Plains	34^{O}43’00.22”S, 139^{O}14’33.59”E	Wheat	30, 55*, 80 kg MAP/ha	Barley	30, 55*, 80 kg MAP/ha
Adrian Bormann	Murray Plains	34^{O}45’29.95”S, 139^{O}13’33.05”E	Wheat	20, 60*, 100 kg MAP/ha	Lentils	20, 60*, 100 kg MAP/ha
David Schmidt	Lowbank	34^{O}12’34.65”S, 140^{O}15’12.41”E	Wheat	20-65 kg MAP/ha VR, 80 kg MAP/ha test strip	Barley	20-65 kg MAP/ha VR, 80 kg MAP/ha test strip
David Schmidt	Lowbank	34^{O}11’48.62”S, 140^{O}15’26.11”E			Wheat	20-65 kg MAP/ha VR, 80 kg MAP/ha test strip
Craig Needs	Lameroo	35^{O}20’25.25”S, 140^{O}29’54.85”E	Wheat	65/30, 65/70, 65/0, 0/0, 100/0 (MAP/Urea – kg/ha)	Lentils	40, 40, 40, 20, 60 on corresponding 2023 strips (MAP – kg/ha)

Danny Steer	Lameroo	35^{O}22’20.86”S, 140^{O}31’25.43”E	Wheat	0/0, 90/0, 45/20, 45/90 (DAP/Urea – kg /ha)	Oats (Hay)	0/0, 90/0, 45/20, 45/90 (DAP/Urea – kg /ha)

Note* In 2024 we had a focus paddock lined up with Tim Paschke (Lowbank) which wasn’t sown due to a very dry start. We’ve included an excellent demonstration paddock of David Schmidt as the second paddock.

RESULTS

From Sean Mason, Agronomy Solutions

Murray Plains

The 2024 season allowed us to replicate 2023 VRT activities with Scott and Zoe Starkey and Adrian Bormann (see table 1).

As a sign of adoption Starkey's implemented an initial VRT phosphorus program based on our work from 2023 where higher P rates were applied on the responsive grey soil types and reduced on the red loam with good P banks (figure 1). Importantly any shift in fertiliser management programs should be verified with fertiliser strips and in 2024, three rates of MAP were implemented as per 2023 at 30, 55 and 80 kg MAP/ha. Three zones were initially set up in 2023 and soil characteristics analysed.

Figure 1: Starkey's 2024 VRT map of varying MAP rates with soil type and placement of different fertiliser strips across zones. Paddock went into Barley in 2024.



Grain yield results from the paddock were collated by Pete Treloar and segmented to each sampling zone for each of the three treatments. The two zones on grey soil types classified as P responsive revealed higher barley grain yields in 2024 between 0.25-0.45 t/ha when P

levels remained at least 55 kg MAP/ha compared to the lowest MAP rate and therefore a significant penalty exists by cutting MAP rates on these soil types (table 2). There was no indication of yield penalties at the non-responsive site (west) for the second season running. PGM analysis across the two seasons outlined benefits of VRT compared to a flat rate of 55 kg MAP/ha of $76/ha and up to $100/ha from the lowest MAP rate of 30 kg MAP/ha. Increases in PGM were mainly attributed to increase grain yields on the responsive soil type with opportunities to reduce P rates on soil types with good P banks, knowing where these soil types exist is imperative for the successful implementation of VRT.

Table 2: Grain yield results for each fertiliser treatment across three sampling zones for wheat grown in 2023 and barley grown in 2024. The VRT rec has used yields obtained from low P rate in the high P zone (west), moderate P rate (middle) and high P rate (east). PGM has been calculated for cumulation of both seasons with wheat at $350/t, barley @ $300/t and MAP at $1000/t.

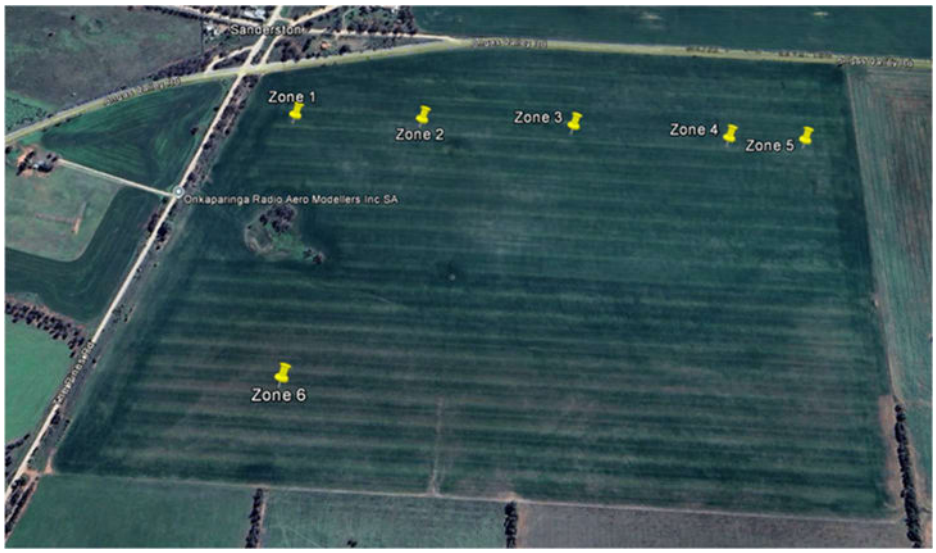
2023 Wheat (t/ha)	30kg MAP/ha	55kg MAP/ha	80kg MAP/ha	VRT rec
High P/Low PBI - West	2.31	2.29	2.22	2.31
Low P/High PBI - Middle	2.03	2.12	2.32	2.12
Low P/High PBI - East	1.94	1.93	2.07	2.07
Full run	2.11	2.08	2.22	2.17

2024 Barley (t/ha)	30kg MAP/ha	55kg MAP/ha	80kg MAP/ha	VRT rec
High P/Low PBI - West	3.93	3.87	3.94	3.93
Low P/High PBI - Middle	2.25	2.70	2.49	2.70
Low P/High PBI - East	2.73	2.90	3.08	3.08
Full run	2.98	3.09	3.16	3.24

2023/24 PGM	30kg MAP/ha	55kg MAP/ha	80kg MAP/ha	VRT rec
High P/Low PBI - West	1928	1903	1900	1928
Low P/High PBI - Middle	1326	1492	1498	1492
Low P/High PBI - East	1437	1486	1589	1589
Full run	1571	1594	1665	1670

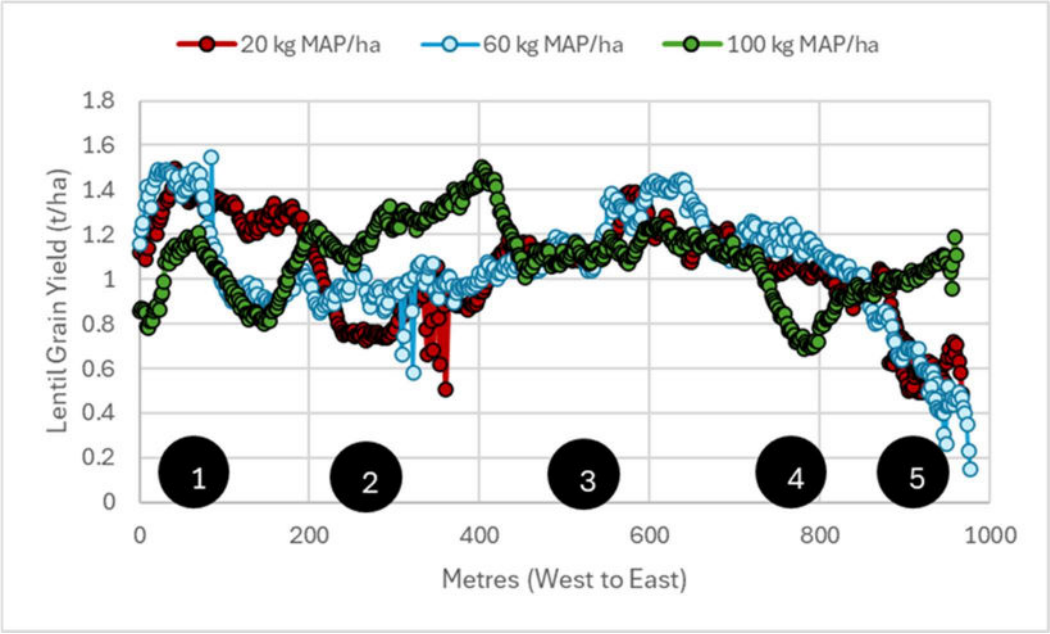
The focus paddock at Adrian Bormann's allowed the assessment of VRT implementation with a lentil phase in 2024 following the wheat phase in 2023. This site was resampled in 2024 prior to sowing as the original sampling had minimal sampling points along the fertiliser strip locations (figure 2). Analysis could therefore be used to inform responses to applied MAP in both 2023 and 2024.

Figure 2: 2024 sampling locations from the low MAP rate set up in 2023 at Adrian Bormann's with these locations presented on the yield data displayed on figure 3.



Lentil grain yields from 2024 were highly sensitive to different fertiliser rates across different soil type zones (figure 3). Soil samples as represented by numbers 1-5 outlined that zones 2 and 5 were predicted to be the most P responsive in association with a grey/calcareous soil type and these two zones outlined the benefit of applying extra P as MAP above the standard paddock rate of 60 kg MAP/ha. Lentils are highly sensitive to soil salinity levels and extra salt induced through higher MAP rates generated negative grain yields mainly highlighted by zone 1.

Figure 3: Lentil grain yields across the paddock and length of the fertiliser treatments for low (20), grower rate (60) and high (100) MAP rates as kg/ha.



Combination of wheat in 2023 and lentil in 2024 grain yields are presented in table 3 for each fertiliser treatment and zone as presented in figures 2 and 3. Based off soil test results the VRT rec rate as MAP (kg/ha) was allocated to 20 – zone 1, 100 – zone 2, 20 – zone 3, 60 – zone 4 and 100 – zone 5. VRT in the second year was very profitable with overall yield gains of 0.1t/ha compared to the flat MAP rate of 60 kg/ha. PGM as calculated previously but including lentils at $800/ha revealed an overall $80/ha benefit of VRT compared to the flat grower rate but within P responsive zones PGM increases of approximately $300/ha were evident between the lowest and highest MAP rate. This highlights the importance of identifying these P responsive zones and while it might be attractive to cut rates back due to lower yield potential this action will cause a greater gulf in PGM between soil type zones across the paddock.

Table 3: Grain yield results for each fertiliser treatment across three sampling zones for wheat grown in 2023 and lentil grown in 2024 at Bormann's. PGM has been calculated for cumulation of both seasons with wheat at $350/t, lentil @ $800/t and MAP at $1000/t.

2023 Wheat Yield (t/ha)				
Zone	20kg MAP/ha	60kg MAP/ha	100kg MAP/ha	VRT Rec
1	2.812	2.869	2.780	2.812
2	2.505	2.928	2.985	2.985
3	2.788	2.855	3.161	2.788
4	2.398	2.697	2.582	2.697
5	2.165	2.577	2.685	2.685
Full	2.534	2.785	2.839	2.793

2024 Lentil Yield (t/ha)				
Zone	20 kg MAP/ha	60 kg MAP/ha	100 kg MAP/ha	VRT Rec
1	1.402	1.438	1.131	1.402
2	0.754	0.955	1.124	1.124
3	1.115	1.116	1.110	1.115
4	1.046	1.157	0.732	1.157
5	0.583	0.639	1.013	1.013
Full	0.980	1.061	1.022	1.162

2024 PGM ($/ha)				
Zone	20 kg MAP/ha	60 kg MAP/ha	100 kg MAP/ha	VRT Rec
1	2066	2034	1678	2066
2	1440	1669	1744	1744
3	1828	1772	1794	1828
4	1636	1750	1289	1750
5	1184	1293	1550	1550
Full	1631	1704	1611	1787

Lowbank

Both the 2023 and 2024 seasons have tested the extremes of VRT profitability in the Lowbank region. We have reported results from two paddocks of David Schmidt's, one that was built on 2023 strip establishment and the other a new paddock established in 2024 with significant variability. Strip testing in these paddocks were slightly different as Pete Treloar had already set up a VRT map based of EM38 mapping and lowering MAP rates on

constrained soils. Within both paddocks two MAP rich (80 kg/ha) strips were implemented and crop responses of the VRT map compared to these strips.

The 2023/2024 paddock (figure 4) expressed very little variability in terms of soil type characteristics with all sampling locations revealing P deficiency driven by high pH and high PBI (fixation). Yields below 1t/ha were obtained for both seasons but responses were observed whenever MAP rates were cut back below 60-65 kg/ha. Increased responses return very small gains in PGM ($10/ha) due to the low grain yields and the relatively high current cost of MAP (table 4). In some cases where 0.2t/ha increases were observed (2024 – zone 3) this effectively paid back the cost of the extra fertiliser required to maximise yields.

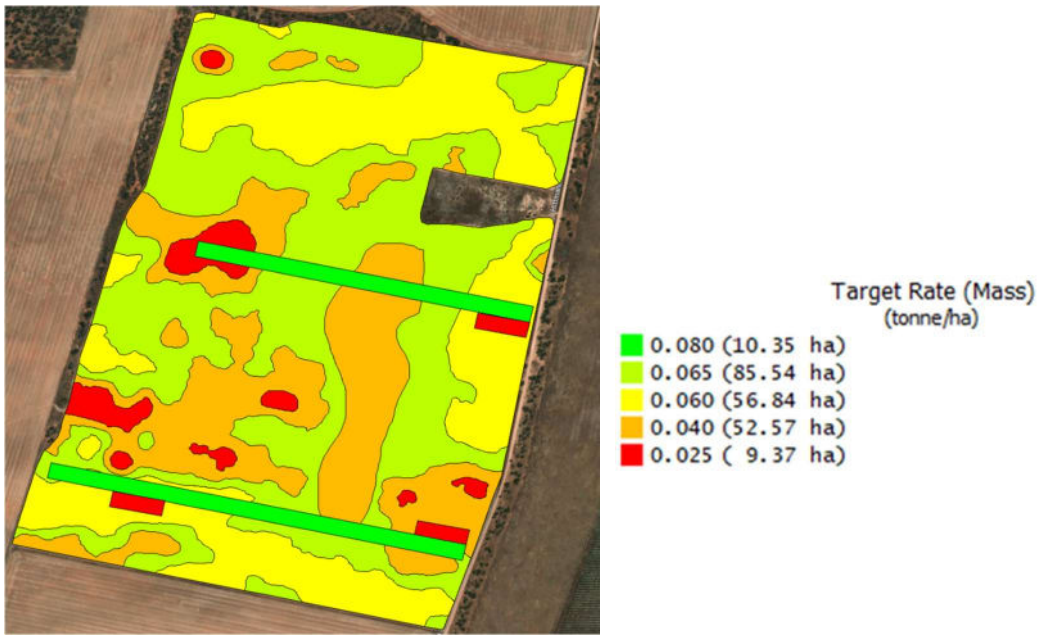


Figure 4: 2023 and 2024 focus paddock at David Schmidt's with associated MAP rates and the sampling locations used for interpretation of expected crop responses to varying MAP rates.

Table 4: Grain yield results for each fertiliser treatment across three sampling zones for wheat grown in 2023 and barley grown in 2024 at Schmidt's. PGM has been calculated for cumulation of both seasons with wheat at $350/t, barley @ $300/t and MAP at $1000

	2023 Wheat Yield (t/ha)			2024 Barley Yield (t/ha)			Total Yield (t/ha)	PGM ($/ha)
MAP rate (kg/ha)	Zone 1	Zone 2	Zone 3	Zone 1	Zone 2	Zone 3	Combined zones	
65	0.741			0.43			0.60	258
80	0.795			0.5			0.65	268
65				0.5				
40		0.728			0.58		0.64	349
80		0.896			0.68		0.79	358
40					0.54			
25			0.869			0.37	0.62	365
60						0.51		
80			0.914			0.56	0.74	328

The new 2024 focus paddock demonstrated significant variability through zonal sampling with varying soil profile N associated with constrained areas through either elevated salinity or boron (table S3). Even without yield data across different treatment strips this alone represents significant benefits of VRT by reducing applied N on constrained soils and to focus N inputs on profitable soil types with no constraints which are highlighted by high in season NDVI values. Soil P levels varied to generally good levels in non-constrained soils but low in constrained areas which tests the benefits of VRT based recs and if addressing the P problem is profitable on areas with already low yield potentials present.

Unfortunately, primarily due to the poor season there was no benefit obtained with VRT in this instance with no response to the P rich strip in any of the tested zones (table 5). The two highest yielding zones (2 and 5) were attributed to areas with no constraints and good P reserves.

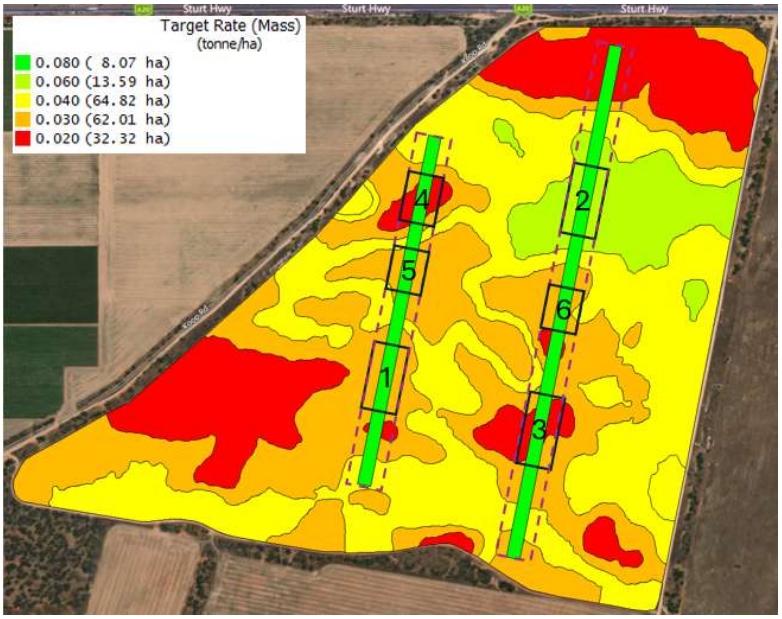


Figure 5: New 2024 focus paddock at David Schmidt's with associated MAP rates and the sampling locations used for interpretation of expected crop responses to varying MAP rates.

Table 5: Grain yield results for each fertiliser treatment across three sampling zones for barley grown in 2024 at Schmidt's. Soil descriptors of each sampled zone can be found at the bottom of the table.

D9 Yield (t/ha)						
Rates (kg/ha)	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Zone 6
30	0.01		0.1	0.055	0.66	0.02
80	0.02		0.07	0.06	0.59	0.07
30	0.01		0.4	0.069	0.51	0.19
60		0.87				
80		0.86				
60		0.84				

Zone 2 – High P, Low PBI, Low N, no constraints (to 50cm)
Zone 4 – Low P, High PBI, very high N, significant constraints (> 10cm)
Zone 5 – High P, Low PBI, Low N, no constraints (to 50cm)
Zone 6 - Low P, High PBI, very high N, no constraints (to 50cm)

Lameroo:

Two focus paddocks in the Lameroo region that were both in wheat for 2023 had contrasting second crop in rotation and tested under VRT conditions. Lentils were sown at the focus paddock hosted by Craig Needs and in accordance with crop responses to various treatments in 2023 the paddock was re-sampled prior to 2024 sowing with 5 zones assessed for nutrient and constraint status. In 2023 Craig had implemented 6 different fertiliser strips with a combination of MAP and Urea (table 6). On the back of these treatments rates of MAP were refined down to 40 kg/ha apart from the nil control which went to 20 kg/ha and the high P strip that went from 100 to 60 kg MAP/ha. This allowed us to test the residual effect of 2023 treatments with both varying background N and P inputs.

Grain yield data for both season with each treatment combination is presented in table 6 with resulting calculated PGM across the two seasons. The preferred VRT rate chosen was on the back of soil analysis (see table S4) and simplified below table 6. Lentil sensitivity with fertiliser inputs on soils with background salinity was again observed. There was an outlier for zone 4 and the high P rate which skewed calculated PGM but the VRT assessed PGM was ranked as the best program along with the high MAP treatment. Increases in PGM of $250/ha were observed for the VRT preferred treatment compared to grower practice of treatment 2. This result emphasis the power of zonal sampling and VRT applications in accordance with soil test results by placing P inputs were required but also allowing areas when P inputs can be reduced without any yield penalty.

Table 6: Grain yield results for each fertiliser treatment across five sampling zones for wheat grown in 2023 and lentil grown in 2024 at Needs. PGM has been calculated for cumulation of both seasons with wheat at $350/t, lentil @ $800/t and MAP at $1000/t. Explanation of VRT rate based off soil test results can be found below the PGM table.

Treatment		2023 Wheat Grain Yield (t/ha)						
Number	MAP/Urea (kg/ha)	Full Strip		Zone 1	Zone 2	Zone 3	Zone 4	Zone 5
2	65/30	4.865		4.620	5.186	4.588	4.765	4.831
3	65/70	4.421		4.510	4.834	3.785	4.519	4.026
4	65/0	4.763		5.159	5.085	4.222	4.741	5.090
5	0/0	4.483		4.972	4.745	3.832	4.006	4.759
6	100/0	4.954		5.248	5.110	4.220	5.344	5.028
	VRT preferred			5.159	5.110	4.222	4.741	5.028

Treatment		2024 Lentil Grain Yield (t/ha)					
Number	MAP (kg/ha)	Full Strip		Zone 1	Zone 2	Zone 3	Zone 4	Zone 5
2	40	0.850		0.754	1.387	0.494	0.942	0.635
3	40	0.810		0.899	1.172	0.431	0.734	0.501
4	40	0.870		1.057	1.194	0.620	0.674	0.667
5	20	1.080		1.849	1.375	0.728	0.399	0.758
6	60	1.170		1.232	1.724	0.518	1.417	0.806
	VRT preferred			1.849	1.724	0.728	0.674	0.806

Treatment		2023/34 PGM ($/ha)						
Number		Full Strip		Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Average
2		2243		2080	2785	1861	2281	2059	2213
3		2030		2133	2464	1504	2004	1645	1950
4		2258		2546	2630	1869	2093	2210	2270
5		2413		3199	2741	1904	1701	2252	2359
6		2510		2662	3008	1731	2844	2245	2498
	VRT preferred			3125	3008	1900	2038	2245	2463

Number	Characterics	VRT preferred
Zone 1	High P/low PBI	Low P
Zone 2	Low P/moderate PBI	High P
Zone 3	High P/low PBI	Low P
Zone 4	Marginal P/acidic	Moderate P
Zone 5	Low P/High PBI, constraints	High P

At Danny Steers, Oaten Hay was sown in 2024 on top of the same treatments applied in 2023. This paddock was one of the only limited cases where there was a distinct lack of response to any combination of DAP with or without Urea in 2023 (table 7). Soil samples were taken prior to 2024 to confirm soil nutrient levels with four zones set up to be tested along the established fertiliser strips. Yields for oaten hay weren't obtainable by we have

used NDVI images for two different periods in season to assess yield responses to various treatments. Visually responses were seen in the low P zones of 3 and 4 where NDVI values increased from approximately 0.35 up to 0.5-0.6 for the 90 kg DAP/ha treatment.
There was also a potential benefit of urea in this case with oaten hay having a moderate N requirement. NDVI values taken near harvesting date in September revealed that these responses had decreased which is not surprising as early NDVI readings are most sensitive to assess response to P and once crops start to senesce there can be an interfering effect on NDVI readings and actual yields present. Visually the preferred VRT rate performed well from NDVI images, but actual returns could not be calculated from the 2024 season.

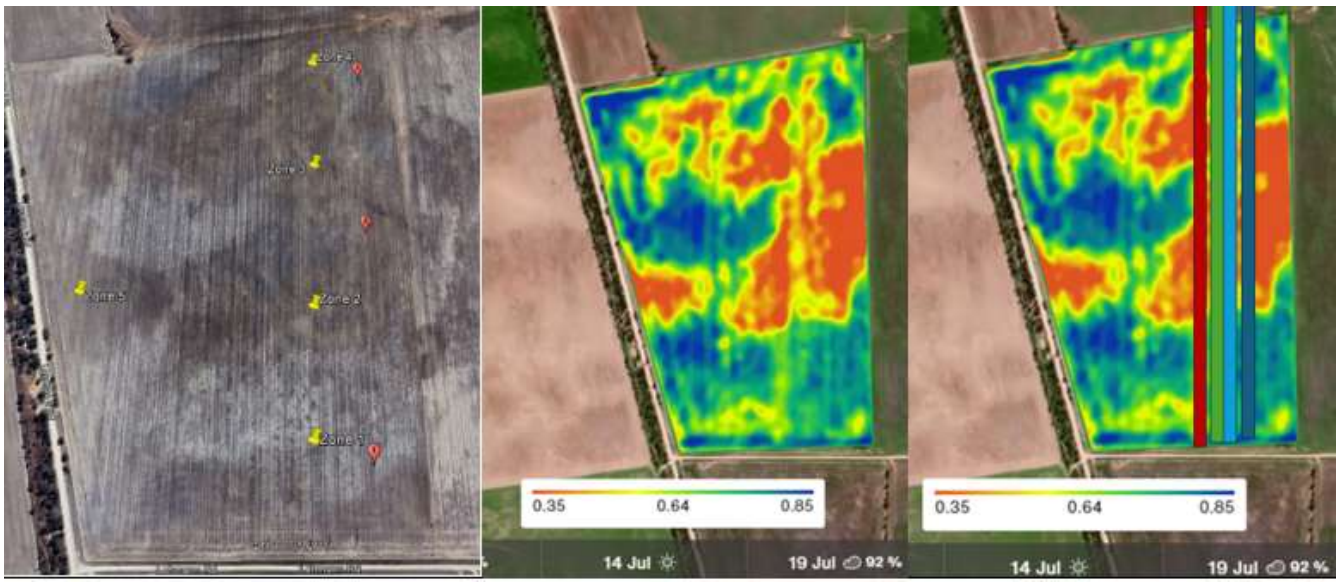


Figure 7: Sampling zones and associated early season NDVI images for Oaten Hay grown in 2024 at Danny Steers. Coloured strips highlight placement of fertiliser treatments which were as follows, red = DAP 0, green = DAP 90, light blue = DAP 45/Urea20, dark blue = DAP 45/Urea 90 kg/ha.

2023 Wheat Grain Yield (t/ha)					
	DAP 0	DAP 90	DAP 45 Urea 20	DAP 45 Urea 90	VRT preferred
Zone 1	4.54	5.12	4.46	4.45	4.54
Zone 2	4.34	4.49	4.39	4.54	4.39
Zone 3	4.62	4.41	4.51	4.09	4.41
Zone 4	4.53	4.38	4.38	3.81	4.38

2024 Oaten Hay NDVI - 14th July					
	DAP 0	DAP 90	DAP 45 Urea 20	DAP 45 Urea 90	VRT preferred
Zone 1	0.64	0.75	0.75	0.75	0.75
Zone 2	0.35	0.50	0.60	0.50	0.60
Zone 3	0.35	0.60	0.40	0.45	0.60
Zone 4	0.40	0.70	0.50	0.60	0.70

2024 Oaten Hay NDVI - 12th September					
	DAP 0	DAP 90	DAP 45 Urea 20	DAP 45 Urea 90	VRT preferred
Zone 1	0.77	0.79	0.82	0.85	0.82
Zone 2	0.86	0.86	0.86	0.86	0.86
Zone 3	0.83	0.83	0.83	0.82	0.83
Zone 4	0.79	0.84	0.84	0.87	0.84

Table 7: 2023 wheat grain yield results for each fertiliser treatment across four sampling zones followed by early and mid-season NDVI values for oaten hay grown on a paddock hosted by Danny Steer.

Appendix

Table S1: Preseason soil results taken from five zones along the 20 kg MAP/ha fertiliser strip at Adrian Bormann's.

Sample Name	Sample Depth	pH CaCl2	Organic Carbon (W&B)	MIR - Aus Soil Texture	Nitrate - N	Ammonium - N	Colwell Phosphorus	PBI	DGT-P
		pH units	% (40°C)		mg/kg	mg/kg	mg/kg		µg/L
AB1	0-10	7.7	1.43	Loam	32	2.4	32	44	106
AB2	0-10	8	1.52	Loamy sand	26	1.9	27	62	37
AB3	0-10	7.52	1.13	Loamy sand	25	2.9	32	41	109
AB4	0-10	7.88	1.24	Loam	24	2	26	48	62
AB5	0-10	7.93	1.23	Loam	20	1.8	22	59	42

Table S2: Preseason soil results taken from four zones at the new focus paddock hosted by David Schmidt.

Sample Name	Description	pH CaCl2	OC	Profile N	N supporting yield	Colwell P	PBI	DGT-P	Constraints
		pH units	%	kg/ha	t/ha	mg/kg		µg/L	
Trial 2	Red/Moderate NDVI	8.11	0.5	25	0.62	27	50	57	None
Trial 4	Grey/Low NDVI	8.03	0.8	199	4.99	35	111	20	Sodium + Salt > 10cm, Boron > 30cm, High Sulphur
Trial 5	Dark Red/High NDVI	8.07	0.6	37	0.91	26	41	109	None
Trial 6	Grey/Low-Moderate NDVI	8.12	0.8	88	2.19	29	89	22	None

Table S3: Preseason soil results taken from five zones along the 0 kg MAP/ha fertiliser strip at Craig Needs.

2023 focus paddock and fertsilier strip trial - repeated in 2024 with Lentils									
Sample Name	Description	pH CaCl2	OC	Profile N	N supporting yield	Colwell P	PBI	DGT-P	Constraints
		pH units	%	kg/ha	t/ha	mg/kg		µg/L	
Zone 1 - 0 MAP	Non Responsive	6.95	1.2	48	1.19	42	32	105	Possible compaction > 25cm
Zone 2 - 0 MAP	P response to 65 MAP	7.76	1.3	98	2.45	15	41	36	Sodium and Boron > 30cm
Zone 3 - 0 MAP	Small NP response	6.87	1.1	70	1.75	27	25	96	None
Zone 4 - 0 MAP	P response to 100 MAP	5.29	1.1	47	1.18	35	31	63	Surface acidity, sodium, salinity throughout, boron > 30cm
Zone 5 - 0 MAP	P response to 65 MAP - Fert toxicity effect	7.85	1.3	91	2.27	18	71	28	Salinity, slight boron > 10cm, moderate boron > 30cm

Table S4: Preseason soil results taken from four zones along the 45/20 kg DAP/Urea/ha fertiliser strip at Danny Steer.

2023 focus paddock and fertsilier strip trial - repeated in 2024 with Oaten Hay									
Sample Name	Description	pH CaCl2	OC	Profile N	N supporting yield	Colwell P	PBI	DGT-P	Constraints
		pH units	%	kg/ha	t/ha	mg/kg		µg/L	
Zone 1 - 45 DAP/20 Urea	High NDVI	7.5	0.89	88	2.19	39	29	152	Marginal salinity, sodium and boron > 30cm
Zone 2 - 45 DAP/20 Urea	Intermediate NDVI	7.99	0.94	97	2.43	26	38	56	None
Zone 3 - 45 DAP/20 Urea	Low NDVI	8.03	1.03	88	2.19	21	69	17	Sodium and boron > 30cm
Zone 4 - 45 DAP/20 Urea	High NDVI	8.05	0.85	110	2.74	27	67	34	Marginal sodium/boron > 10cm, high soium/boron > 30cm
Zone 5 - Main pdk	Low 2023 NDVI	7.94	1.31	130	3.24	30	90	32	Sodium and boron > 30cm

CONCLUSION

The 2024 season presented significant challenges for assessing the value of VRT in terms of nutrient responses and ROI from input due to significant moisture stress and late season frost events. Results outlined in the bulk report outlines how far growers have come in terms of maximising soil moisture and converting that to yield, some of the yield results were impressive given the challenges mentioned. Importantly 2024 provided further evidence of how VRT can be implemented on-farm, tested through fertiliser strip trials and partial gross margins/ROI assessed.

The reported growing season results focused on permanent inputs stirps of varying amounts and included different crop types, namely lentils and revealed significant savings can be made from VRT action across seasons and rotations and it is important to assess if VRT is suitable for each individual situation across multiple years. Zoning, soil sampling procedures and subsequent input requirements were in line with the methodology outlined with the newly created Easy VRT platform which enables expansion of VRT to other areas and uses without necessarily the involvement of the project team.

Creating the VRT platform through real life examples Chris McDonough worked on zoning, Yield and Soil Insight in the areas he supported around Murray Plains and Waikerie.

In collaboration with these and other growers in the regions, Chris McDonough utilised the Agri Solve platform to deepen understanding of soil variability and optimise paddock zoning

for Variable Rate Technology (VRT). Through this partnership, Agri Solve helped interpret seasonal yield responses, particularly during a dry 2024 season where crop performance was driven more by soil type and plant available water (PAW) than fertiliser inputs.

Using yield maps from 19 trial paddocks, Chris highlighted how PAW, not nutrient limitation, determined yield variability. This offered a powerful opportunity to identify soil zones that behave differently under stress gutless sands vs heavy constrained clays and reinforced that poor yields do not always indicate poor fertility. Instead, such data helped better align NDVI imagery, soil pit characteristics, and rainfall timing with real paddock responses.

Chris used this information to refine zoning, integrating soil test data and NDVI history with local seasonal rainfall profiles to classify soils into opportunity/risk categories. This in-depth process supports more tailored nutrient planning and zone management. His work with the various growers is now feeding directly into the Easy VRT tool, ensuring its recommendations reflect real-world soil behaviour and improve usability for farmers adopting VRT.

Future Adoption Opportunities for Easy VRT and VRT Trial Strips

The Easy VRT platform provides a repeatable, accessible way for farmers to implement Variable Rate Technology, making it easier to create zones, adjust fertiliser strategies, and revisit paddock data over time. Combined with the use of long-term trial strips, farmers are gaining clearer insights into how different soils and zones respond to fertiliser across varying seasons.

With ongoing support from MSF and technical partners, more growers are seeing the value in refining inputs, managing risk, and building a clearer understanding of how to get more from their paddocks. This dual approach platform access and in-field validation is helping farmers take confident steps toward wider VRT adoption.

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