

Variable Rate Application

IS IT RIGHT FOR YOUR FARM?

Precision agriculture (PA), or site-specific crop management, is a farming concept based on observing, measuring and responding to variability across and between fields. These practices have expanded in tandem with technologies such as global positioning system (GPS) and various remote sensing and imagery techniques and autosteer machinery guidance systems.

The idea behind PA is that the more accurate you can be, the more uniform your crop is and the lower the production costs can be. It all adds up to being more profitable.

RIGHT AMOUNT – RIGHT PLACE – RIGHT TIME

3 WHY DO IT?

On the forefront of technology in horticulture, it is important to determine why you want to use VR. Be clear on your objective, do you want to:

Solve a problem (e.g. drainage)	Improve uniformity of crop growth	Improve quality
Increase yield	Improve profit	?

Results from Queensland vegetable growers highlight some of the benefits:

- 75%** yield increase in underperforming areas
- 25%** reduction in granular fertiliser
- 40%** reduction in lime

1 WHAT IS VARIABLE RATE APPLICATION?

Variable rate (VR) application is one element of PA.

After generating spatial maps of variables that can be measured (e.g. yield, topography, organic matter content, moisture levels, pH, EC, nutrient levels), this data can then be used by variable rate technology (i.e. seeders, sprayers) to optimally distribute inputs to your crop.

What can you apply at variable rates?

- Irrigation
- Fertiliser and lime
- Seed
- Soil amendments.

How did it start out?

In broadacre cropping such as grains variable rate application of fertiliser is quite common.

Cost savings from a Tasmanian wheat grower:

“Variable rate last season saved me \$25,000 on fertiliser yet I produced some of my best crops”.

How is it being used in vegetables?

In contrast with other agricultural sectors, variable rate technology and practice are still fairly new and not commonly used in the vegetable growing sector. It's most often used to apply fertiliser, as well as irrigation under centre pivot systems (e.g. carrots, potatoes).

Lessons from a Victorian vegetable grower:

“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.”

“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.”

4 HOW TO DO IT?

Practical Tips

Do you have a problem field?

- Step 1. Collect data/observe variability – imagery, mapping, remote sensing, yield mapping (e.g. EM38, NDVI, drones)
- Step 2. Assess causes – ground-truthing (e.g. gridded soil sampling, visual assessment, shovel test)
- Step 3. Apply targeted variable rate treatment (e.g. fertiliser application, gypsum)
- Step 4. Evaluate impact – improvement/benefit gained (e.g. uniformity, yield, cost savings)

Gaps in knowledge?

Interpretation of causes of variability is important to ground-truth with local agronomic knowledge. For example, we often don't know what NDVI, EM38 or drone data are telling us in vegetable fields. It's important to:

- Take soil samples to know what's causing the variability in your field
- Know the history of the block – previous land use, old access tracks, and cutting and filling for land levelling can all cause variability
- Get out in the field with a shovel – this can really help understand what is behind the variability on the ground.

2 WHAT IS AVAILABLE?

Crop sensing to measure the health and vigour of plants and variability within a crop:

- Remote sensing and satellite imagery, useful for covering larger areas and crops grown over a longer time period
- UAVs or drones, useful for smaller areas or targeting specific areas of your farm
- Tractor or vehicle-mounted crop sensing, useful to see variation in real-time and multiple passes can be made in the same growing season to track changes while completing standard field operations

Soil monitoring to understand where and what is causing the variability:

- EM38 mapping provides insights into soil constraints such as soil texture, salinity and/or water held in the soil profile (indication of drainage), which is relatively cost-effective at approximately \$35/ha
- Gridded soil sampling at different depths to further investigate nutrition, pH,

electrical conductivity and soil texture variation with a specific block, rather than aggregating samples from the same block. However, this can be costly

- Zonal soil sampling based on the 'main zones' identified by crop sensing measures above, which is more targeted, provides more precise information and is more cost effective than gridded sampling

Prescription maps based on combining crop sensing and soil monitoring results:

- Software to combine results yourself is available, or there a number of service providers that can do this for you
- You can control the number of zones created and the input rates assigned to each zone based on the requirements (e.g. nutrients, lime, water)

Applying inputs using variable rate application equipment:

- Machinery – variable rate fertiliser or compost spreaders and seeders
- Irrigation systems – centre pivot or lateral move systems

Key questions to ask

Clear purpose

What do I want to achieve by making a change to VR?

Understand focus area

Where is the greatest degree of variability in crop yield occurring on my farm? What is causing it (e.g. soil chemistry, drainage)?

Start small

Where can you trial the application of the technology on part of your farm first? There will be valuable lessons to apply across the rest of your farm if you decide to proceed.

Cost-benefit

How much will it cost to make the transition (e.g. new/modified machinery)? What will I likely save in input costs? Will the uniformity or yield benefit outweigh the costs?

Degree of benefit possible

How much or how likely are the estimated benefits? Margins for improvement can be quite fine in high-performing production systems, however savings to be made from reducing excess amounts of input can save big bucks

Stay connected

Who are the leading growers or industry service providers in this area? Reaching out and discussing insights with others as you progress is key. Also, keep an eye on social media and articles of interest from overseas.

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WHERE CAN I GO FOR MORE PRACTICAL TIPS AND TOOLS?

Check out these great resources from the Soil Wealth ICP project team:

- Exploring the application of precision agriculture: Koo Wee Rup demonstration site [case study](#)
- Precision ag pays off in bumper celery crop: Koo Wee Rup demonstration site [case study](#)
- Precision ag pays off in bumper celery crop: Koo Wee Rup demonstration site [podcast](#)
- Variable Rate Technologies in Queensland vegetables [video](#)
- Veg and tech: Science fiction or the future of farming? [global scan and review](#)
- Remote sensing [global scan and review](#)

There's also a range of other great fact sheets, videos, case studies and global scans available at www.soilwealth.com.au