Sugar Research Australia

Information Sheet
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Variable-rate technology

Variable-rate technology (VRT) allows fertiliser, chemicals, lime, gypsum, irrigation water and other farm inputs to be applied at different rates across a field, without manually changing rate settings on equipment or having to make multiple passes over an area.

Variable-rate application (VRA) can range from the simple control of flow rate to the more complex management of rate, chemical mix and application pattern. VRA can match changes in crop yield potential with specific input rates resulting in a more efficient system and minimising potential environmental impacts.

VRT can be used to deal with spatial variability between paddocks or between management zones/classes. There are two types of VRT:

1. Map-based control: a map of application rates is produced for the field prior to the operation.

2. Real-time control: decisions about what rates to apply in different locations are made using information gathered during the operation. This requires sensors to detect necessary information 'on-the-go' and is usually designed for a specific job such as herbicide application.

Here we will focus on map-based control, which is more commonly used in sugarcane.

Requirements of VRA systems:

- Prescription maps to provide site- or zone-specific input rates. These types of maps are generally created using Geographic Information Systems (GIS) software.

- Global Navigation Satellite System (GNSS) such as GPS to help the applicator interpret the prescription map.

- Variable-rate capable machinery (sprayer, spreader, etc). It is often possible to adapt existing machinery and methods for doing so will vary from one piece of equipment to another.

- A controller that uses application maps to vary the rate of input. Many tractor navigation systems incorporate VRA map reading and control signalling ability.

VRA requires a high level of data management and interpretation. Benefits of VRA are generally higher when:

- the amount of spatial variation is larger

- the pattern of variability is more coherent patches (fewer rate changes required)

- variability patterns are stable over time

- the cost of inputs is relatively high (for example, benefits are higher for VRA of gypsum than for VRA of nitrogen).

There are different types of variable-rate equipment, and you should carefully consider your needs before purchasing or modifying equipment. Also, consider that liquid fertilisers can usually be applied more accurately at varying rates than granular fertiliser. Some applicators can only vary the rate of one product, however, in many cases soil needs for different nutrients will vary across a block.

Additional flexibility can be achieved by using a fertiliser box with multiple compartments such as the one in the image below. This fertiliser box has three compartments that are controlled separately through the three black controllers to the right of the tyre.

VRA decisions should be based on a thorough understanding of a farm's variability and potential yield variability of the crop being grown. This requires multiple layers of information collected over time.

Assistance from a consultant or other agricultural professional can help with navigating computer software, equipment and complex decisions.

References

University of Southern Queensland. 2013. *Precision and smart technologies in agriculture, study book.* Faculty of Engineering and Surveying. 166pp.

Whelan, B. and J. Taylor. 2013. *Precision Agriculture for Grain Production Systems.* CSIRO Publishing. 199pp.