



Precision agriculture in vegetable production



National Vegetable
Extension Network

VICTORIA - NORTHERN,
WESTERN & SOUTH EASTERN

Overview

Precision agriculture (PA) technologies have been widely adopted throughout various agricultural industries in Australia, but what exactly is PA, and what benefits can it provide the Australian vegetable industry? This fact sheet provides information on the different types of technologies that are available, what they do, and how they have the potential to benefit your farming system.

What is precision agriculture?

Precision agriculture (PA) is the use of new technologies in collaboration with existing practices to perform a range of specific on-farm tasks. Also commonly referred to as site specific crop management or SSCM, PA works to better manage practices and inputs to match variations that occur in the environment. As opposed to an 'all-in' approach when applying fertilisers, chemicals, and other inputs, PA aims to assess the needs of specific areas and plants in the field and apply the required inputs accordingly.

As well as better managing inputs, PA technologies also encompass a range of innovative new ways to harvest, manage pests, weeds and diseases, and understand more about the needs of vegetable crops (e.g. irrigation, nutrition). Whilst PA technologies use a range of new technologies to help increase productivity, reduce costs and environmental impact, they still rely on conventional agricultural operations to work. They won't work as a silver bullet and address all problems, but used wisely they have the potential to better manage specific areas of your growing operation. Some of the most widely used PA technologies used in vegetable production include:

- **Global navigation satellite systems or GNSS** (commonly known as GPS) – used as guidance systems for the navigation of tractors, bed formers, and other on-farm machinery

- **Yield mapping/monitoring** – used to understand the variations in crop health in specific areas of a field and provide information for decision-making
- **Nutrient/water monitoring** – used to understand the variations in nutrient/water uptake and flow, and provide information for decision-making
- **Variable rate controllers** – technology that allows varied amounts of inputs to be applied to specific areas needed, such as water and fertiliser.

Key messages

- Precision agriculture technologies help growers to better manage inputs to meet the needs of vegetable crops
- Benefits of precision agriculture include maintaining uniformity across the crop, reduced costs associated with inputs, and greater knowledge of in-field variation to inform decision-making and management
- Technologies currently available to vegetable growers include a range of tools that aid in on-farm sensing and monitoring such as variable rate application and controlled traffic farming
- Important considerations when thinking of using precision agriculture in your vegetable production system include: i) get the fundamentals right; ii) know what you're going to use the technology for; iii) find technology that operates with your existing equipment; iv) invest time and effort up front; and v) remember not all technologies are right for every farm

Benefits of using PA in vegetable production

PA technologies have the potential to benefit a wide range of vegetable production systems through reducing costs associated with labour, being more precise with the application of inputs, and having a greater knowledge of the in-field variation in different parts of your farm. As mentioned, PA shouldn't be thought of as a silver bullet in dealing with all problems, rather as something that will assist you in being more efficient with your current systems. Benefits to production systems can include:

- Increased accuracy of bed formation
- Reduced compaction
- Greater knowledge of drainage patterns
- Greater knowledge of soil structure/types
- Increased input efficiency (e.g. water, fertilisers)
- More effective control of pests, weeds, and diseases
- Increased consistency of crop development
- Increased marketable yield
- Increased hygiene standards.

The use of PA technologies, with existing agronomic knowledge, has the potential to result in a more productive and profitable vegetable business.

CLICK HERE: <http://www.abc.net.au/news/2016-02-11/precision-agriculture/7162914> to watch a video on the benefits of PA adoption

Technologies currently available

The advancement technology in recent years has reduced the price and increased the reliability of ag-tech products, making them more easily accessible for vegetable growers and others in the industry.

Since the early 1990s a wide range of technologies have been developed to assist farmers in producing better quality products, at a lower cost, in a more productive manner. There are a wide range of technologies that are now common practice in farming systems around the world that aim to do this. In Australia, the uptake of technologies has been seen in a wide range of agricultural industries all the way from production to packing. The most popular and widely used technologies in the Australian vegetable industry include a range of sensing

equipment that are designed to aid in performing tasks like fertiliser application, soil sampling, farm mapping, and yield/nutrient/water monitoring. The most established of these in Australian vegetable production being controlled traffic farming (CTF) and variable rate application (VRA). CTF enables growers to use the same wheel tracks when planting, spraying and harvesting, resulting in reduced compaction and runoff, and potential increases in yield. VRA allows growers to better match inputs with the needs of crops, by applying the required amount of inputs to the specific area it's needed in the crop (e.g. water, nutrients).



CLICK HERE: <https://www.youtube.com/watch?v=4JbKaAsyRkl&feature=youtu.be> for more information on controlled traffic farming and variable rate application

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Many companies have jumped on board, innovating and investing in new technologies for growers. Ag-tech company The Yield has created a range of sensing products that aim to aid growers in completing a range of on-farm tasks. One of their products was developed through a Hort Innovation funded project, which includes data analytics and app technology to guide on-farm irrigation scheduling. The end result of this project was an application, that can be accessed through the app store, which takes data from the Bureau of Meteorology and translates it into relevant on-farm information for growers. The data that's presented in the app includes information on temperature, evapotranspiration rates, water balance and wind activity. This information, which is provided on a regular basis and is specific to your location, has the ability to aid growers in irrigation scheduling and other water management tasks.

CLICK HERE: <https://www.theyield.com/products/free-growers-app> for more information on The Yield's free app for vegetable growers

Robots in vegetable production

Due to increasing issues with labour availability and rising input costs, there has been a focus to develop autonomous robots to perform a range of weed and crop monitoring, sensing, and harvesting tasks in vegetable production. These technologies have been gaining rapid traction over the past few years, with a range of technologies emerging both in Australia and internationally.

RIPPA (Robot for Intelligent Perception and Precision Application) and its cousin, Ladybird, are autonomous robots that have been designed through the Horticulture Innovation Centre for Robotics and Intelligent Systems (HICRIS) at the University of Sydney's Australian Centre for Field Robotics (ACFR). Funded through Hort Innovation using vegetable industry levies and funds from the Australian Government, these new technologies aim to increase sensing, automation and decision-support on farm. RIPPA, which is currently still under development, has the ability to:

- Identify and mechanically remove weeds
- Detect and remove foreign objects in-field
- Monitor crop and soil health

- Administer precise amounts of herbicides to specific target weeds
- Monitor crop growth.

Similar to RIPPA, there is a long list of robotic systems that have been designed to assist vegetable growers in producing more with less. Large companies like Bosch, Yamaha and John Deere, have been involved in developing new robotic systems, as well as smaller start-up companies like Ecorobotix and Blue River Technologies overseas.



CLICK HERE: <https://www.youtube.com/watch?v=kITGHCTmCoY&t=1s> for a short video on RIPPA demonstrating its abilities in field

Adoption of PA technology

PA technologies have been used extensively throughout agricultural industries since the early 1990s, however, the rates of adoption have varied across different industries. This variability can be attributed to a range of factors which commonly involve the complexity of the products, interoperability problems with different hardware/software devices, and the initial costs of some of the equipment.

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Due to the potential savings on inputs and increased productivity involved with the adoption of PA technologies, there have been initiatives set out to try and increase the adoption rates of PA technologies in Australia. Organisations like the Society of Precision Agriculture Australia (SPAA), have aimed to help growers and others in the industry understand the benefits of PA in agricultural systems. Similarly, a current project run by the Queensland Department of Agriculture and Fisheries aims to focus on adoption rates in Australia by taking commercially available PA technologies and implementing them on vegetable farms. The project, which has demonstration sites located all over Australia, takes a wide range of different technologies based on the needs of different growers, and implements them on-farm to demonstrate how they have the ability to improve production. This includes EM38 mapping to identify soil constraints, variable rate irrigation in centre pivot systems, as well as yield monitoring and mapping in different crops.



CLICK HERE: <http://www.soilwealth.com.au/resources/articles-and-publications/adoption-of-precision-systems-technology-in-vegetable-production-highlights-january-june-2018/> for the most recent project highlights.

Important considerations

PA has the potential to benefit a range of growing systems, there are however several important things to consider when thinking of using PA technologies in your production system. When determining whether you need PA technologies for your farm, think back to the basics of production, and work out how you will benefit from using

these technologies. Keep in mind that PA technologies won't help solve problems related to the fundamentals of production, rather it will assist in making your current practices more efficient and precise. Remember to follow these important principles:

1. **Get the fundamentals right:** make sure you're doing everything correctly in your production system before you spend money on additional technology.
2. **Know what you're going to use the technology for:** some technology can be expensive, if you have any existing PA technology, make sure you're using it to its full potential before investing in any more. Have a clear purpose.
3. **Try and find technology that is able to interact with one another:** to reduce interoperability problems, make sure the software/hardware you invest in is compatible.
4. **Invest time and effort:** make sure you invest the time and effort into learning how to use the technology, so you get the most out of it. Document information on how to use the technology so it's easier the second time round, and for your employees to use.
5. **Not all technologies are right for every farm:** every production system is different and requires different tools and technologies. What works for one farm may not work for another.

Further information

For further information on precision agriculture in vegetable production watch [this 1-hour informative webinar](#) that involves a range of industry professionals and covers a breadth of topics relevant to the vegetable industry: <http://www.ausvegvic.com.au/pages/precision-agriculture-technology-in-vegetable-production-systems-webinar-recording/>

CLICK HERE: <http://horticulture.com.au/hortlink-2018-edition-1/vegetable/> if you'd like more information about current Hort Innovation projects related to PA in vegetable production.