Farmer Case Studies on the Economics of PA Technologies

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Abstract

There has been a rapid adoption of Global Positioning Systems (GPS) for guidance and autosteer by grain growers in Australia in the last five years. The aim of this study was to quantify the economic benefits of precision agriculture (PA) on eight farms across southern Australia. The PA technology evaluation included yield mapping and VRT, as well as GPS guidance and autosteer. It is hoped this information will provide farmers and advisors valuable background information in deciding whether an investment in PA will improve individual farm profitability.

Introduction

It is estimated that 30% of broadacre crops in Australia are now sown and/or sprayed using GPS technology. However, other precision agriculture (PA) technologies such as yield mapping and variable rate is less common with <1% of adoption across cropping regions in Australia. One of the major reasons for this is the lack of evidence that the investment in variable rate technology (VRT) can provide sound financial returns to farmers.

Methods

Eight farmers were interviewed from different cropping regions of southern Australia and with varying levels of PA experience (Table 1). Information was collected on,

- Area of cropping program, crops grown, crop yields, gross margins, rainfall, soil types
- Variable input costs (fuel, fertiliser, seed, pesticides, machinery, labour) per hectare (ha)
- GPS equipment purchases and purpose
- Evidence that PA is working on their farm in regard to less overlap, VRT etc
- Other benefits of PA e.g. conducting own agronomic experiments

This information was collated, analysed and a case study prepared on each individual farmer.

Table 1. Location, rainfall, farm size, and PA experience

Farmer	Location	Rainfall (mm)	Farm operation (ha)	Years of PA experience
1	Waikerie	250	3000	7
2	Crystal Brook	400	1600	8
3	Yeelana	425	2700	2
4	Snowtown	400	2340	10
5	Buckleboo	300	4475	5

6	Stockport	475	1200	10
7	Urania	400	1300	10
8	St Arnaud	400	2400	11

Economic analysis

A relatively simple economic approach was used in this study. The total cost and annual benefit of GPS equipment for each farming operation was calculated and expressed as a total and in $/ha; benefits were deemed to accrue through generation of profit or saving on input cost. From this, a "payback period" was determined which is the time taken for the equipment to "pay for itself". The payback period is a function of the annual benefit relative to the initial cost of the GPS equipment and the time taken for the benefit to be instigated. After this payback period, income generated from the GPS equipment becomes profit. The quicker the payback period, the better the investment. The total cost of equipment for each farmer was calculated from the original purchase price (gst exclusive). Savings on input costs were based on reduced overlap using GPS equipment. This was calculated using the farmers' figures on the individual paddock area that was sprayed, fertilised etc before and after GPS equipment was used. Savings using VRT were calculated from comparing variable rate fertiliser application with a previous "blanket" rate of fertiliser used before PA was employed. Production increases from VRT were calculated from higher yields achieved by increasing fertiliser rates on low fertility areas of paddocks. On-farm trial data was used for this purpose. Production increases from inter row sowing were estimated using trial data. Actual farmer data on grain prices and input costs was used in the majority of calculations. Estimates were used when this was unavailable.

Results and Discussion

Costs and Benefits

The costs and benefits from PA in this study are summarised below (Tables 2 and 3). For all cases the annual benefit from cost savings and increased production was enough to cover the cost of guidance and autosteer equipment within three years on average (range of 1-7 years). The payback period for yield monitoring and VRT equipment was longer, at seven years on average (range of 1-10 years). This can be explained by two factors. Firstly, the initial high price of yield monitoring in the mid to late 90's before the equipment became standard on most modern harvesters less than ten years old. Secondly, for most farmers it was some years before a VRT program was implemented because farmers were not confident to go full VRT over the whole farm until they had experimental evidence it would work. The first step in gaining confidence was targeted soil testing which revealed that varying rates of phosphorus (P) fertiliser was a viable option because low yielding areas were high in P, and high yielding areas were low or adequate in soil P. Some of the farmers were reducing their overall fertiliser input using VRT, while others were increasing production on low P areas within paddocks e.g. sand dunes. Involvement with organisations such as SPAA (Southern Precision Agriculture Association) was important in verifying potential returns from PA. Farmers looking to adopt PA in the future are better positioned to make VRT pay within two to three years because of access to lower cost equipment (yield monitor, VRT equipment) and more information on the likely financial returns.

Table 2. Summary of costs and benefits of GPS equipment

Farmer	Cost of PA equipment ($/ha)	Annual benefit	Payback period (years)	
			Yield monitor and VRT	Autosteer and

		($/ha)	equipment	guidance
1	23	11	1	4-5
2	62	13	10	1-5
3	27	21	-	1-2
4	15	15	6	1
5	12	10	-	5
6	62	37	9	3
7	104	14	-	2-7
8	44	19	-	2-5
Average	44	18	7	3

Table 3. Breakdown of PA benefits

Farmer	Annual benefit ($/ha)			
	Savings in overlap	Fertiliser savings using VRT	Increased production using VRT	Other production benefits[A]
1	4	-	7	-
2	5	5	-	3
3	3	-	-	18
4	5	10	-	-
5	2	-	8	-
6	10	9	-	18

7	14	-	-	-
8	6	-	-	13
Average	6	8	7	13

[A] inter row sowing, reduced soil compaction, shielded spraying

Other major benefits of PA

The reduction in fatigue was highly rated as a benefit of guidance and autosteer amongst all eight farmers. The ability to conduct your own agronomic experiments was an important benefit for three farmers. Such experimentation has the capacity to lead to better whole-paddock or whole-farm decisions that increase profit.

Management time spent by farmers on PA

Most of the farmers interviewed spent between three and seven days per year organising yield and variable rate maps. Most used basic software supplied by manufacturers and machinery dealers. Although the software was basic, it is fair to say the level of computer and GPS literacy amongst these farmers was high. A lower level of computer literacy may be a significant barrier for further adoption of VRT by others. Some farmers used the advice of a PA or agronomic consultant in preparing variable rate maps. In contrast, guidance and autosteer takes very little training or on-going management.

Conclusion

PA technology offers farmers opportunities to increase their profitability if they make a sound investment in the equipment required. A simple feasibility study is an important first step. In regard to VRT, farmers today are well-placed to take advantage of the knowledge gained from the growers in this study who have been the early adopters of PA technology. Also, the cost of PA equipment has rapidly become more affordable in the last five years which will enhance the profitability of adopting PA for many farmers.

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