

Appendix 37. Views of sugarcane industry participants on Precision Agriculture

August 2014

Tony Webster, John Panitz, Troy Jensen

Introduction

Sugarcane industry participants have been surveyed five times since 2007 to elicit their views on Precision Agriculture (PA), and to inform research providers of the industries priorities for PA research.

The first survey, in May 2007, was taken prior to project CES022 at the conclusion of a PA workshop organized by SRDC at the Sofitel Reef International in Cairns. The workshop received two presentations from Rob Bramley (CSIRO) and Rod Davies (FSA Consulting in partnership with NCEA) who had each been commissioned by SRDC to examine current research and experience with PA in a range of cropping industries (CSIRO) and to describe how PA technologies operate, their uses, opportunities, limitations, risks and costs (FSA). The presentations formed the basis of SRDC Technical Report 3/2007 'Precision agriculture options for the Australian sugarcane industry'. Approximately 60 people attended the workshop, and 36 completed the survey.

The second survey, in September 2008 was conducted as part of project CSE022 at regional workshops that were organized by the project in the Herbert and Burdekin regions. At the workshops the background to the project and project objectives were presented and discussed. The need for the project to have a collaborating farmer in each regions was discussed, and farm visits made to decide collaborating farmer sites. At the workshop participants completed a survey. A total of 37 people completed the survey.

The third survey, in May 2010, was conducted at a CSE022 organised precision agriculture forum held in conjunction with ASSCT that year in Cairns. At the forum four papers were presented, the chair of SPAA (a grower-based PA advocacy group; www.spaa.com.au) made an address, and a facilitated PA panel discussion took place. Approximately 60 ASSCT delegates attended the forum, 19 of whom completed the survey.

The fourth survey, in November 2011, was conducted with project regional meetings in the Herbert, Burdekin and Bundaberg regions. The meetings presented PA research being undertaken by CSE022, and to obtain feedback of PA research and communication. Approximately 50 participants attended the regional meetings, with a total of 34 completing the survey.

The final survey was conducted in August 2014. A link to an online (Survey Monkey) survey was emailed to 1,543 sugarcane farmers on the SRA e-newsletter contacts list on Thursday 24th July asking farmers to participate. When the survey closed 18 days later, 327 respondents (302 identifying as sugarcane growers) had completed the survey.

Survey responses

The 2007, 2008, 2010 and 2011 surveys asked a smaller number of questions in comparison to the 2014 survey. Two of the questions from the earlier surveys can be compared with questions in the 2014 survey. The following analysis starts by describing the responses received in the 2014 survey,

and finishes with an analysis of the two questions where comparisons can be made over all the surveys.

2014 Survey analysis

In the 2014 survey respondents were asked to nominate their sugar milling region, and area of sugarcane grown. The respondents represented all sugar milling regions in Australia, close to proportionate with the number of growers in each region (Figure 37.1). 302 respondents indicated they grow sugarcane. Over 25% of respondents grow more than 200 hectares, with 17% indicating they grow less than 50 hectares (Figure 37.2). This is not proportionate to the average farm sizes in the sugarcane industry, and suggests there was a preference for bigger farmers to be ones who completed the survey. This is possibly due to PA being something that bigger farmers are more interested in; they were therefore more likely to complete the survey.

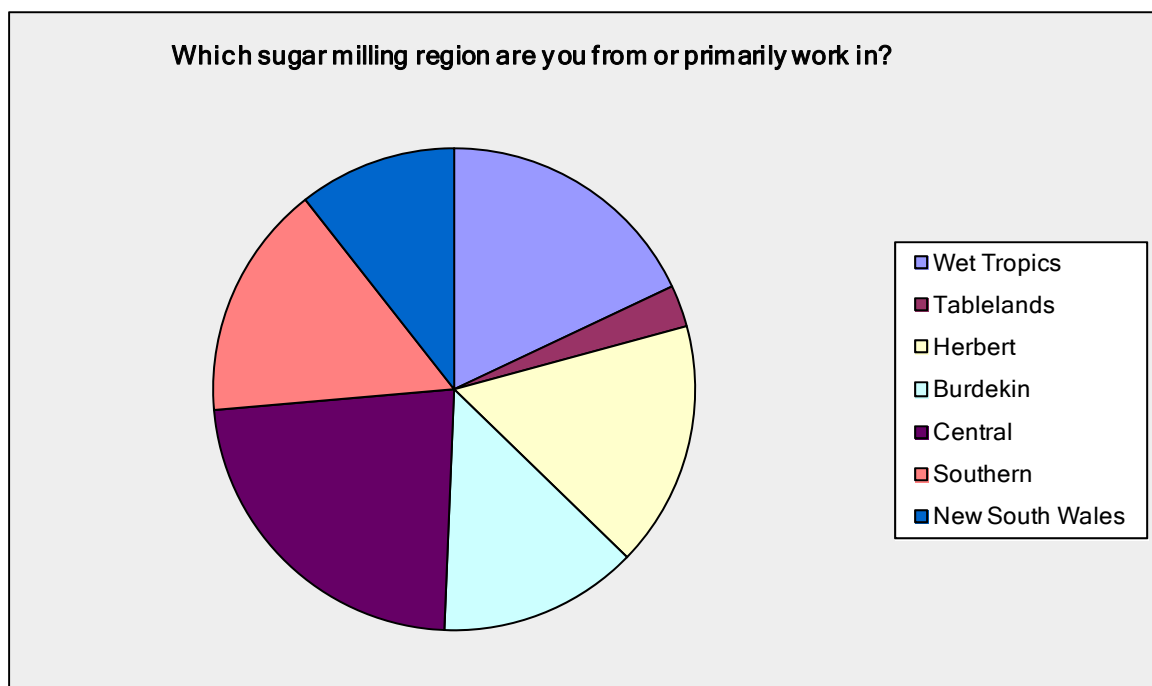


Figure 37.1 Milling area distribution of survey respondents in 2014 (n = 322)

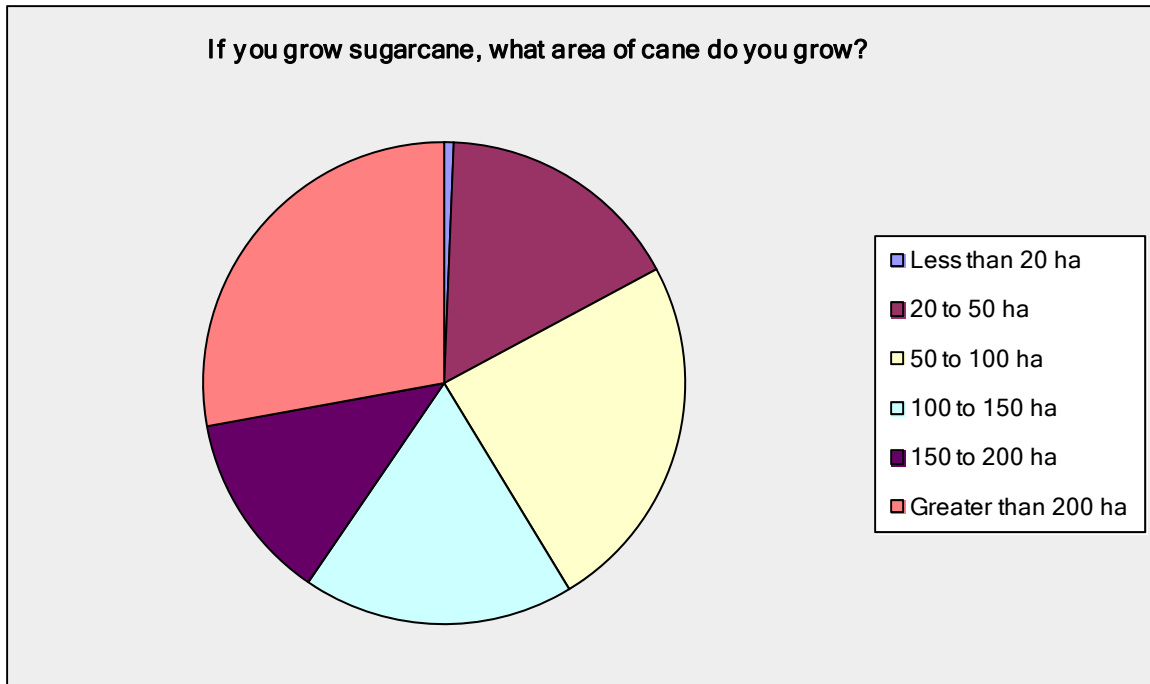


Figure 37.2 Farm size distribution of those that grow sugarcane that completed the survey (n = 302)

The results presented below were stratified to include farmers only, and classified farmers as those that grew less than 100 hectares (n = 115), those that grew between 100 and 200 hectares (n = 91), and those that grew more than 200 hectares (n = 80).

Participants were asked their opinion of what they thought their understanding of PA was. There was a strong trend that the biggest farmers considered that they had a greater understanding of PA than others. 76% of farmers growing more than 200 hectares considered they had a good or expert understanding, 57% of farmers with 100 to 200 hectares considered they had a good or expert understanding, and 42% of farmers with less than 100 hectares considered they had a good or expert understanding.

Those that have an understanding of PA are most likely to source their information from what might be regarded as 'traditional sources' for the sugarcane industry in Australia – that is industry magazines, other farmers and farmer meetings. These three sources were each used by more than 50% of farmers (Figure 37.3). Next most popular sources of information were industry associations and productivity services. Of what might be considered 'new' sources of information, 34% of farmers use the internet for information, yet only 6% are using YouTube to source information on PA. One might think that over time these two sources of information will become more popular. Private consultants and agribusiness (including PA equipment suppliers) are used by 20% of farmers, which might be higher than would be used for other aspects of growing sugarcane.

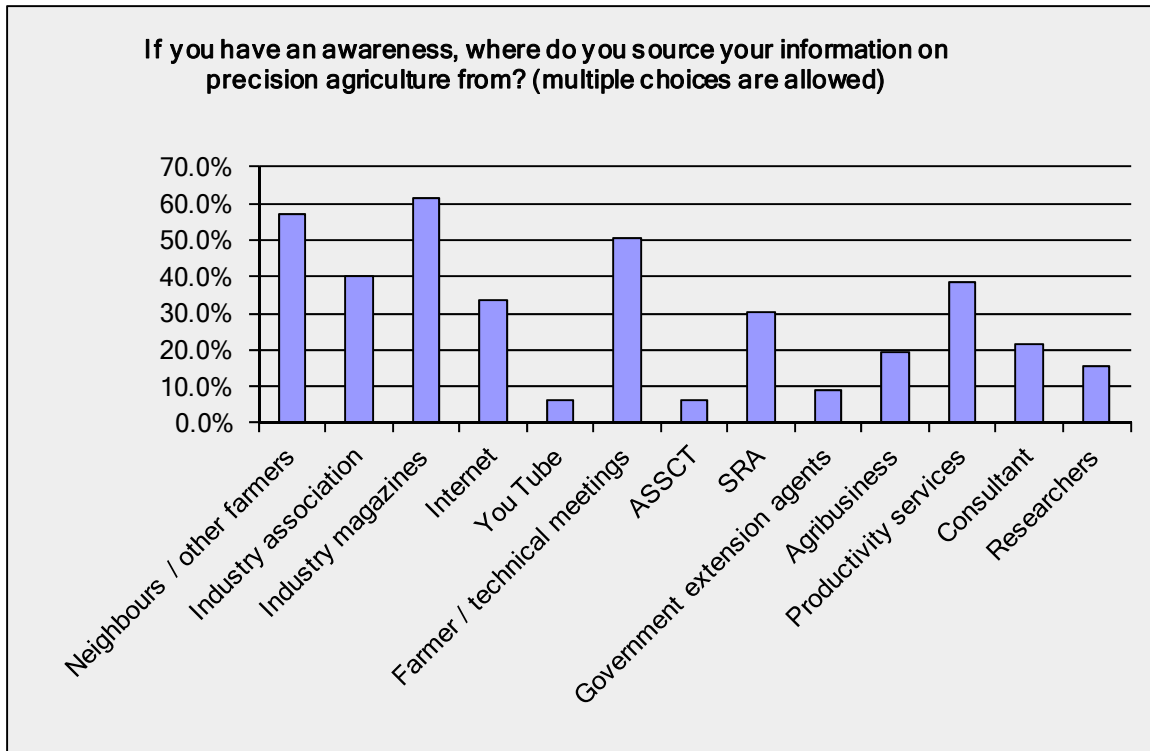


Figure 37.3 Sources of information used by farmers who obtain information about PA (n = 295)

The use of guidance by survey respondents overall was high, especially for guidance on machinery other than harvesters and haul outs (57%), and 27% for harvesters and haul outs (n = 292). The use of guidance was skewed towards the larger farm size – the bigger the farm, the more likely guidance was used (84% of farms greater than 200 hectares use guidance on machinery other than harvesters and haul outs vs 38% of farms less than 100 hectares). The use of guidance is not in itself an indicator that farmers are using PA because PA is a way of using spatial information to inform better management decisions – guidance is not PA per se. However, guidance (and the associated GPS) technology is an enabling tool for PA; that is, it facilitates implementation of PA.

Of the technologies that would be regarded as PA tools, there was overall a generally low rate of adoption, except that 23% of farmers responded that they use variable rates of fertilizer, sprays, lime, gypsum etc within a single block. Again this data showed a strong trend that the larger the farm, the more likely variable rate application was adopted (Figure 37.4).

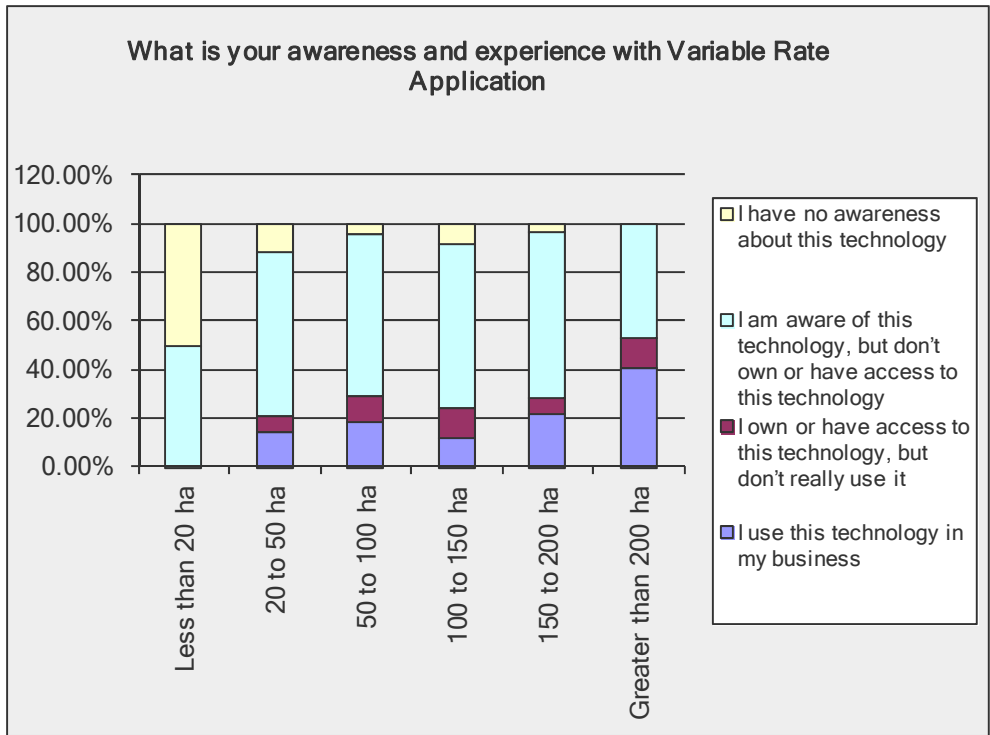


Figure 37.4 Percentage of farmers awareness and experience with variable rate application (n = 285)

Of the other PA technologies, there was 8% adoption of yield monitoring and 15% adoption of yield mapping – again skewed towards higher adoption on bigger farms, although not as pronounced as for variable rate application. There was less than 10% adoption of remote sensing, and only 1% adoption of proximal sensing. Less than 50% of all farmers were even aware of proximal sensing and only 75% of respondents were aware of remote sensing (Figure 37.5). There was an overall adoption of 17% for high resolution soil survey, with those that farm more than 200 hectares reporting a 27% adoption rate, and those that farm less than 100 hectares reporting an adoption rate of 6%.

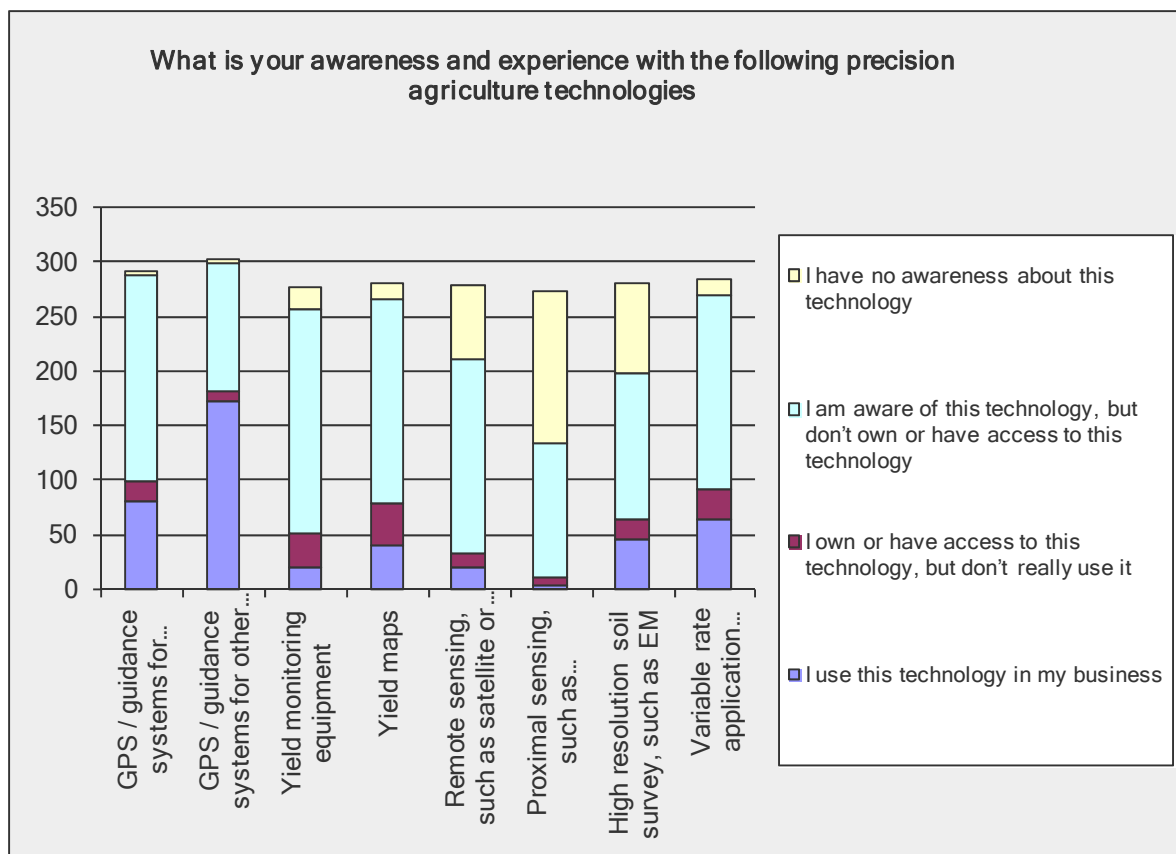


Figure 37.5 Adoption and awareness of various PA technologies

Survey participants were asked to list the limitations they perceived there were to adopting PA technologies (Figure 37.6). The percentage of respondents who reported they believed there were no major impediments to adoption was higher than 30% for some of the technologies (47% for guidance for non harvesting equipment, 36% for variable rate application, 33% for harvester guidance, 31% for high resolution soil survey and 30% for yield mapping). Those who believe yield monitoring and remote sensing has no major impediments was around 20%, while only 13% of respondents believed there was no major impediment to adoption of proximal sensing.

Cost to setup the technology and lack of knowledge in how to use a technology were the two major limitations to adoption reported. Cost was listed as a limitation by greater than 20% of respondents for all of the technologies, with guidance (both harvesters and non harvesting equipment) and variable rate application being identified by over 40%. Cost as a limitation is more likely to be less of a factor for larger farms, which shows in a number of the analysis for this survey. Larger farmers are more likely to adopt PA, and economies-of-scale is one factor driving this. The Australian Federal Government through its Reef Rescue program has helped fund the purchase of over 700 variable rate application units in the Wet Tropical, Burdekin and Mackay districts over the past five years. This has been an acknowledgement that cost can be a limitation to adoption, and an attempt to overcome this limitation.

When the limitations “I do not know how to use”, “It is too difficult to use” and “Not enough technical support to use” are summed, these combined limitations were identified by more than 33% of respondents for yield monitoring, yield mapping, remote sensing, proximal sensing and high

resolution soil survey. These limitations can be overcome through service providers such as consultants and extension services, so this data suggests there is a demand for these services in the Australian sugarcane industry.

Other limitations such as time taken to use and non compatibility with existing equipment were minimal limitations according to survey respondents.

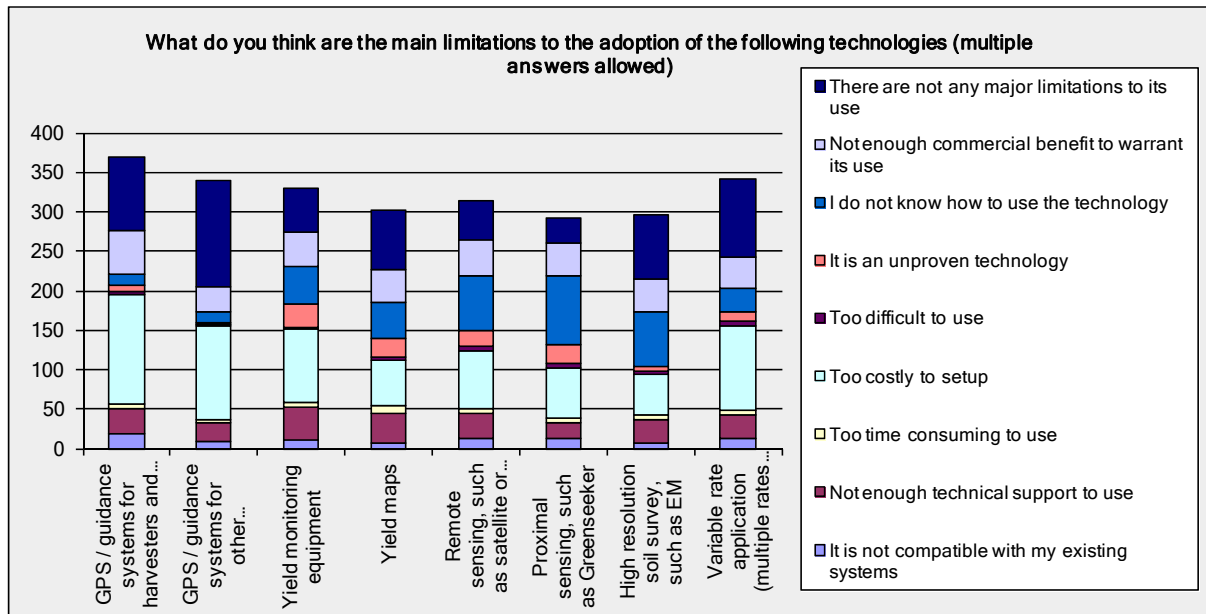


Figure 37.6 List of limitations to adoption for various PA technologies (n = 291)

The number of farmers who plan (or don't plan) on implementing PA technologies is presented in Figure 37.7. As discussed above, there is a skewness towards larger farms for those that already use the technologies. For those growers that have not yet implemented an activity, many do plan on implementing in the following five years (Table 37.1). The percentage of farmers planning to implement technologies, and the degree to which it is more likely that larger farms would plan to implement various technologies, depends on the technology. More than half of all farms of 100 to 200 hectares and greater than 200 hectares plan on implementing yield monitoring and yield mapping in the following five years. An even greater percentage (65%) of these farms also plan on using variable rate application in the following five years. This data suggests that it is this size farm that should be targeted in extension programs for PA in the future. There are more plans for the larger farms (over 200 hectares) to implement remote sensing, proximal sensing and high resolution soil survey. Farms under 100 hectares tend to be less likely to plan to implement these technologies; however, more than 30% in this bracket plan to implement guidance, yield maps, high resolution soil survey and variable rate application.

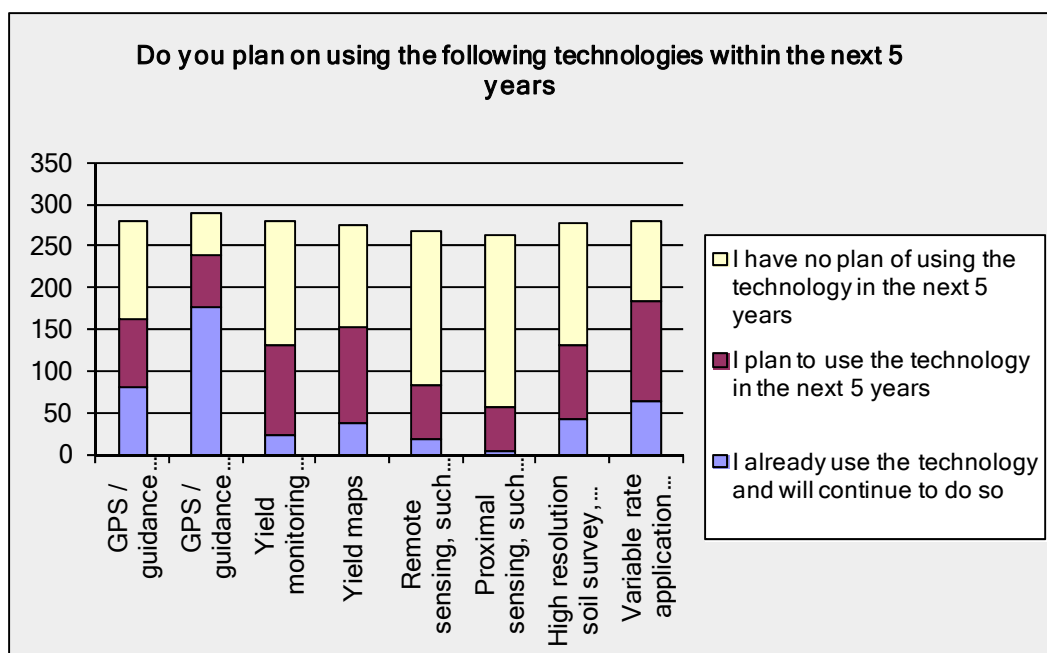


Figure 37.7 Plans over the next five years of farmers surveyed to use various PA technologies

Table 37.1 Percentage of farmers surveyed who plan to implement the following PA technologies in the following five years

Technology	Plan to implement in the following five years (%)		
	Farm size (hectares)		
	<100	100–200	>200
GPS / guidance for harvesting or haul out	36%	42%	49%
GPS / guidance for other equipment	51%	61%	62%
Yield monitoring	26%	49%	56%
Yield maps	34%	53%	62%
Remote sensing	16%	21%	42%
Proximal sensing	15%	13%	31%
High resolution soil survey	30%	35%	54%
Variable rate application	37%	65%	67%

All survey comparison of benefits and future research and development

Over the first four surveys participants were asked to score, in their opinion, what they thought the benefits of various aspects of PA were to the Australian sugarcane industry. An analogous question in the final survey asked participants to consider what they thought the commercial benefits of these technologies were.

In the first four surveys there were consistent scores within each technology, with all but selective harvesting receiving an average score above 7.5 (Figure 37.8). In the 2014 survey 90% of participants believed guidance for non harvesting equipment and variable rate application either are or would deliver a commercial benefit, 85% thought the same of yield maps and yield monitoring, 80% believed guidance for harvesting equipment and high resolution soil survey would or are delivering commercial benefits and 65% thought so for remote and proximal sensing (Figure 37.9). These data suggest participants in the Australian sugarcane industry have held since 2007, and continue to hold, the view that a number of PA technologies are suited to, and likely to provide commercial benefits to the industry.

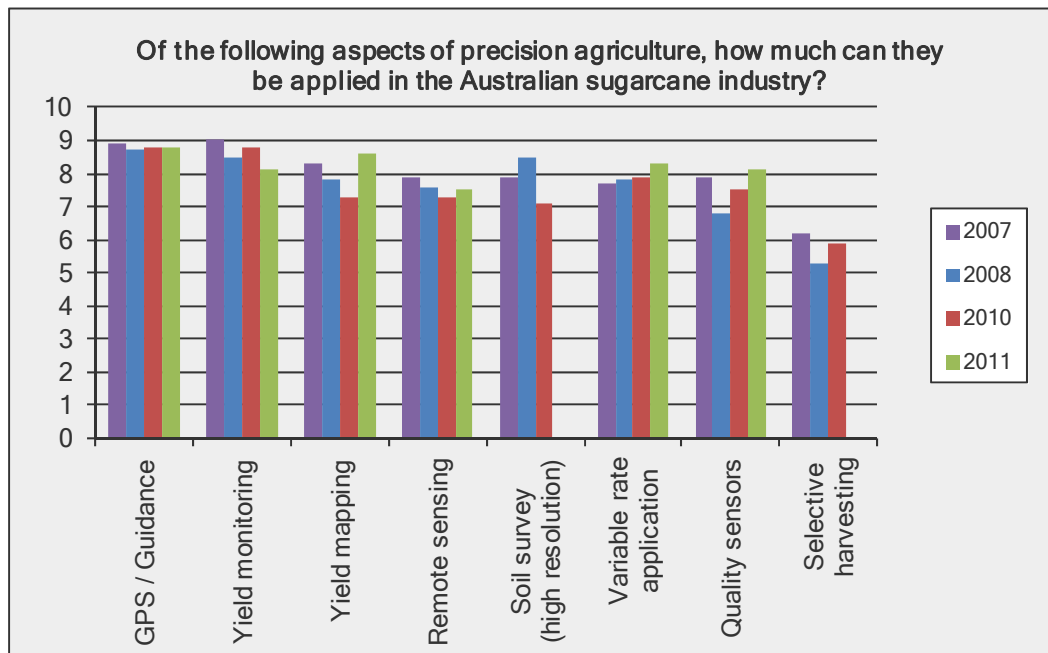


Figure 37.8 Average survey scores (1 to 10) for all participants in surveys in 2007, 2008, 2010 and 2011 asking what they thought about the benefits of various technologies for the Australian sugarcane industry

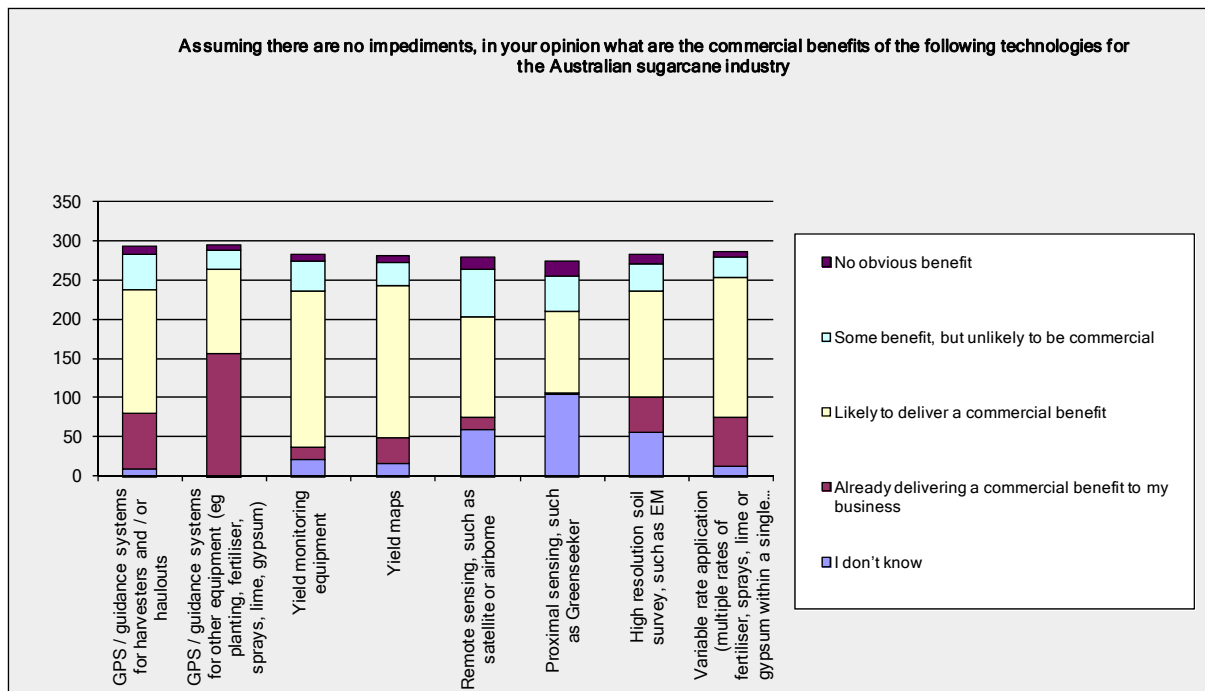


Figure 37.9 Responses from the 2014 survey asking respondents their opinion on the commercial benefits of various technologies for the Australian sugarcane industry (n = 296)

Participants in the first three surveys were asked how strongly they supported further research and development for various PA technologies (Figure 37.10). There was a fair degree of consistency across the three surveys, with strongest support for yield monitoring, economic and environmental benefits of PA, and variable rate application. There was the lowest support for research money to be invested in selective harvesting and guidance. Comments from the surveys suggested many thought guidance was a mature technology, and therefore research money should not be spent on it.

In the 2014 survey the strongest support (determined by summing the large and moderate investment options) is for research into economic benefits of PA, quality sensors, variable rate application and yield monitoring (all with 57 to 59% support for moderate or large research investment) (Figure 37.11). The lowest support is for research investment in proximal sensing, high resolution soil survey and guidance. It could be that those technologies are considered to be the most mature, and therefore not in need of research money, although previous questions highlighted the lack of knowledge about proximal sensing among respondents, so perhaps this interpretation is not so for proximal sensing.

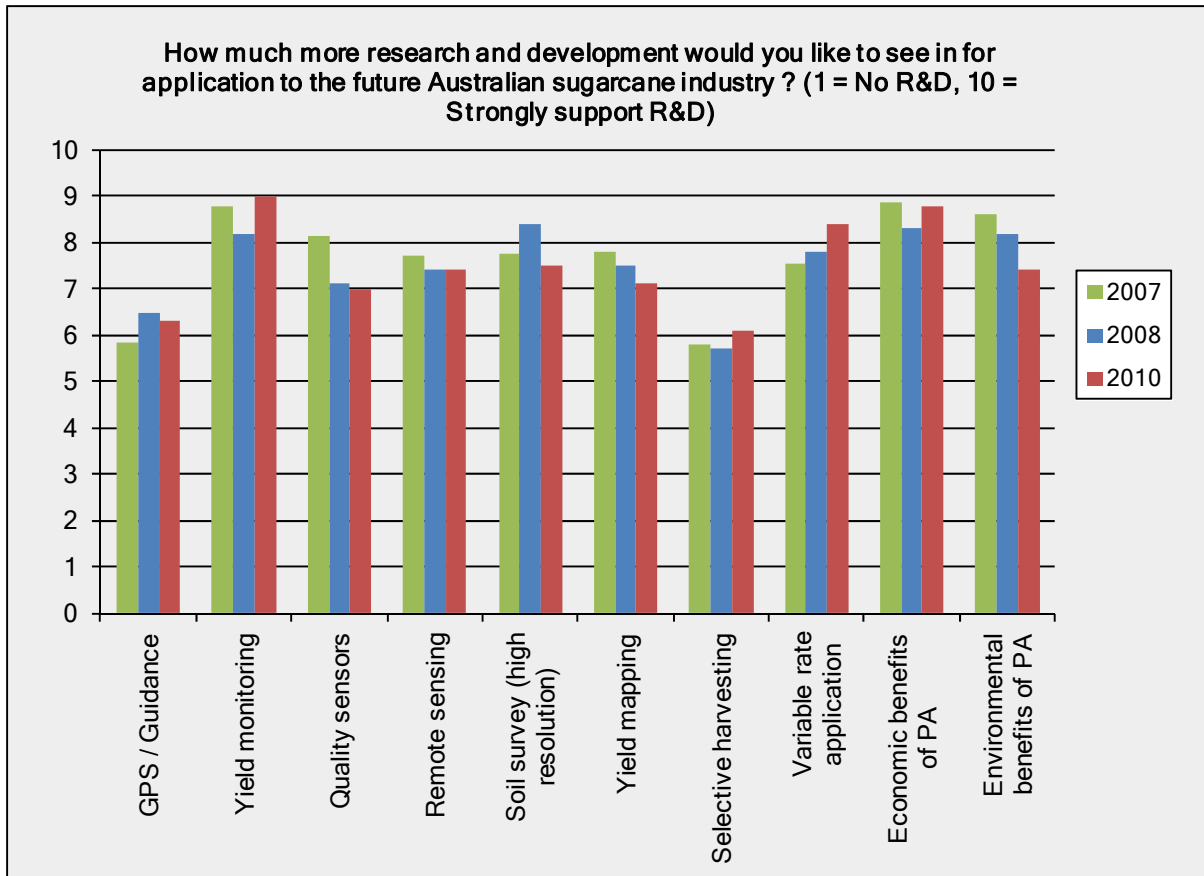


Figure 37.10 Average survey scores (1 to 10) for all participants in surveys in 2007, 2008 and 2010 surveys asking how much research and development they would like to see for various PA technologies

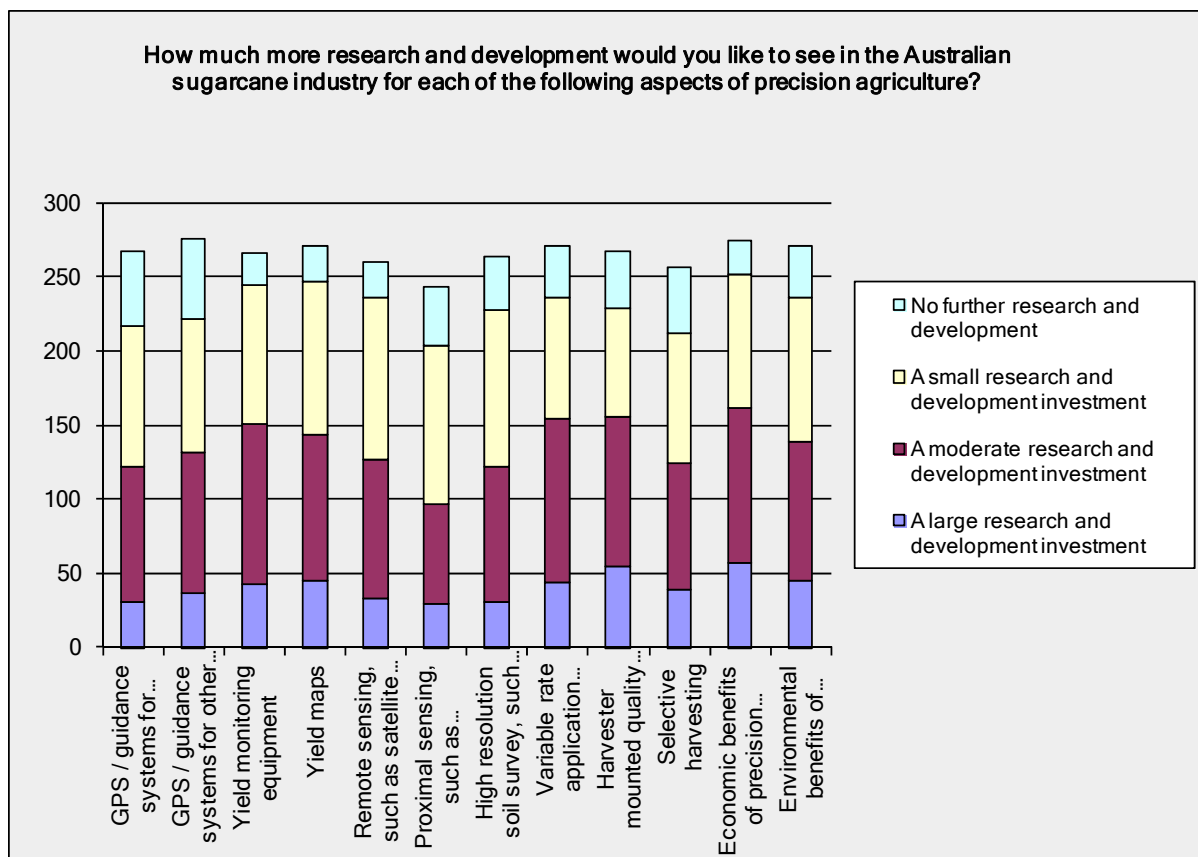


Figure 37.11 Responses from 2014 survey asking how much further research and development investment they would like to see for various PA technologies (n = 282)

Analysis and conclusion

These surveys suggest there is a strong interest, which is starting to be converted into adoption, of PA technologies in the Australian sugarcane industry. Adoption is higher among the larger farms (greater than 200 hectares), however there is adoption in farms less than 200 hectares.

Even though PA is a management approach where computers and technology are ubiquitous, farmers are still gleaned most of their information from traditional sources – magazines, other farmers, meetings. Future research, development and extension effort needs to be cognizant of this. Having stated that, the use of the internet as a source of information by farmers is not insignificant, and should increase over time.

Farmers tended to have a good awareness of some of the PA technologies, although about half are unaware of proximal sensing, and a quarter unaware of remote sensing and high resolution soil survey such as EM. Most farmers were aware of yield monitoring, yield mapping and variable rate application. This translates into higher plans for implementation of yield monitoring, yield mapping and variable rate application, and greater support for further research and development in these areas.

Cost and lack of knowledge on how to use a technology (especially for proximal and remote sensing and high resolution soil survey) are the two main identified limitations to adoption. The actual cost of remote sensing and high resolution soil survey is not exceedingly high when consultants are used,

so perhaps farmers are generally unaware of the costs involved. A number of farmers have received financial support from the Australian Governments Reef Rescue program to help purchase equipment such as guidance and variable rate application technology, and there were comments that this should continue. The comments section also contained a number of comments that PA was more economic for bigger farms – which is evident from this data too.

There are a large number of farmers in the Australian sugarcane industry who plan on implementing some PA technologies over the coming five years, most notable yield monitoring, yield mapping and variable rate application. There is a higher proportion of farms greater than 100 hectares in size that are planning this than smaller farms. Indeed 65+% of farms greater than 100 hectares plan on implementing variable rate application whereas (a still healthy) 37% of farms smaller than 100 hectares are planning on implementing variable rate application.

The industry has a strong belief that PA will deliver commercial benefits, especially for the larger farm sizes. This belief is particularly strong for yield monitoring, yield mapping and variable rate application.

Since 2007 there has been strong industry support for research in the Australian sugarcane industry that looks at the economic benefits of PA, yield monitoring and variable rate application. This support is still strong, with quality sensors added since the 2014 survey. Project CSE022 has highlighted a number of issues with yield monitoring, and the further investment in an SRA project in yield monitoring is justified. Project CSE022 has made a small advance on variable rate application and economic benefits of PA, and it appears these two areas at least are still supported by the industry.

In conclusion, these data suggest that PA is starting to become a part of the Australian sugarcane industry, and the respondents indicate that the future implementation of PA in the Australian industry is highly likely. There is still some uncertainty in the industry about exactly how implementation will occur, with a number of limitations identified, but a strong belief that commercial benefits will result. Support for further investment to help the industry research and develop PA exists.