Autonomous farm machinery use in Australia - a snapshot

April 2025

Prepared by Grain Producers Australia

EXECUTIVE SUMMARY

The Grain Producers Australia (GPA) Autonomous Farm Machinery Survey Report details the current attitudes of broadacre grain producers throughout Australia. The survey of producers was conducted as a part of a new partnership aimed at driving the safe and effective arrival of fully autonomous farm machinery, in Australian agriculture.
The findings of the survey highlighted grower concerns about affordability of fully autonomous (driverless) farm machinery, concerns connectivity in rural areas would not be able to support increasing use of the technology and a lack of confidence in skills to adopt the technology.

The survey showed, however, that interest in the technology itself is high, with 61 per cent of participants keen to learn more, particularly through hands-on demonstrations and field days. There is a contingent of those interested in the technology however, who are only after online materials and courses to expand their knowledge.

Efforts to support grower uptake and large-scale adoption of autonomous farm machinery in Australia could include targeted education involving upskilling and general knowledge, connectivity infrastructure improvement, financial incentives or grant schemes and ongoing technical support.

INTRODUCTION

The global market for autonomy and intelligent systems is expected to experience significant growth in the coming decades, with projections estimating that it will reach a substantial $272 billion by 2027. To remain competitive in the global grain market, Australian grain growers need to improve supply chain efficiency, access new technology, and have a competitive trade agenda.

This is why Grain Producers Australia (GPA), the Tractor and Machinery Association of Australia (TMA) and the Society of Precision Agriculture Australia (SPAA) initially partnered in 2019 to develop the Code of Practice for Agricultural Mobile Field Machinery with Autonomous Functions in Australia.

The Code of Practice was developed with input from grain producers throughout Australia with manufacturer support and technical input from Australia, the US and the EU. It is an exciting and proactive initiative that is designed to enable future access to a rapidly emerging technology that will deliver productivity gains for growers and the industry.

In 2021, the groups have committed to a new three-year partnership to support the Code's implementation as one owned and driven by industry, and other new initiatives to support common goals. The initiative, which includes Code of Practice and other related activities, presents an opportunity for industry to own and lead the adoption of this technology in a safe and effective manner.

As a key component of the new partnership, the grower survey results show how growers are concerned with key aspects of the technology, but also recognise opportunities and are keen to learn more.

The survey was conducted both over the phone and via an online form consisting of 14 questions, some open-ended and some closed to allow elaboration and some clear, measurable feedback.

The key questions focused on current use of the technology, grower-identified benefits gained from using it on their farm, barriers to adoption for those not currently utilising autonomous farm machinery and interest in learning more.

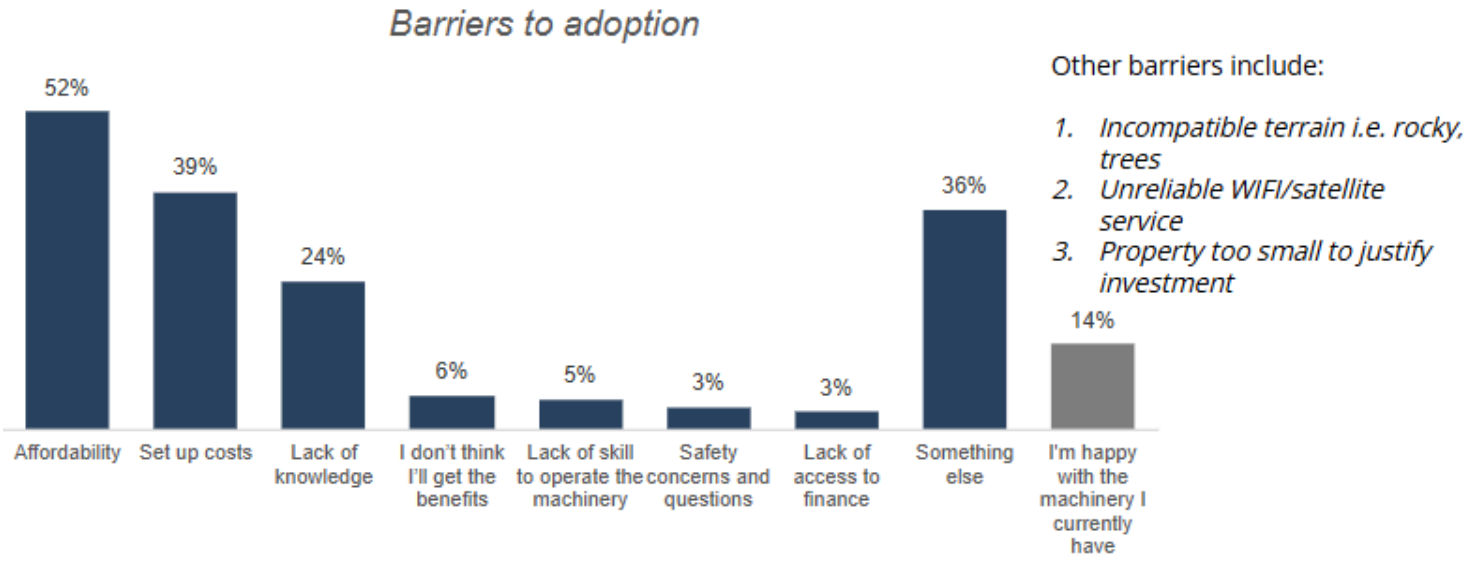
METHODOLOGY

The survey was designed to gain feedback from farmers or farm managers from around Australia on their use and understanding of autonomous farm machinery, barriers to adoption and perceived benefits of use from those utilising the technology on farm.
The survey comprised 14 questions, some of which were multiple choice or requiring yes or no answers, while others were structured to be open-ended that could allow elaboration on the participant's specific situation. In the early stages of the phone survey being conducted, it was identified that there was confusion from growers as to what constitutes autonomous farm machinery. GPA provided clarification for those running the survey, but also encouraged the collection of this feedback as it adds to the overall understanding of the current state-of-play.
Phone surveys were conducted with 150 growers from all states and territories and an online survey was completed by 57 growers, the link for which was shared across GPA, SPAA and TMA networks.

RESULTS

Barriers to adoption

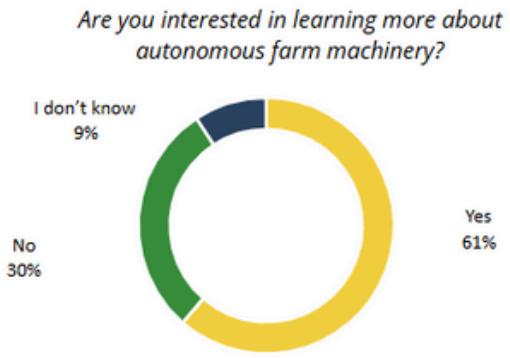
Cost concerns relating to affordability (52%), set up costs (39%) are the clear barriers to adoption identified by a majority of survey participants. This question also highlighted a low knowledge base exists and skepticism towards possible benefits to adoption.



Willingness to learn

Almost two thirds (61%) of participants indicated they would be interested in learning more about autonomous farm machinery. Of those who would like to learn more (n=127), the top three methods they would prefer to engage is via agricultural field days (62%), the Grains Research and Development Corporation (GRDC) (57%) and machinery dealers/retailers (49%).

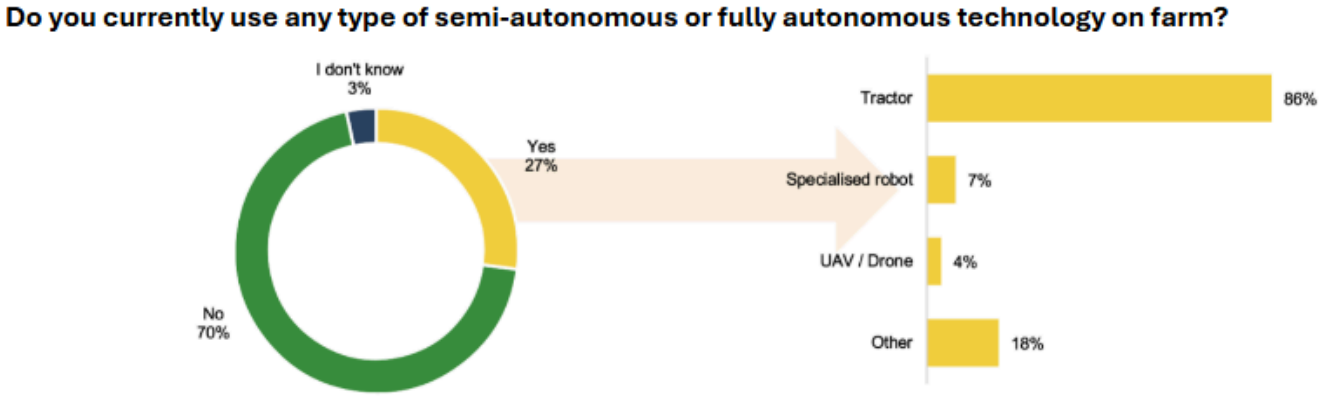
Access to online videos (43%) and webinars (35%) also featured strongly in responses, highlighting a need to offer in-person and offline material to suit all audiences.



Autonomous farm machinery use and definition

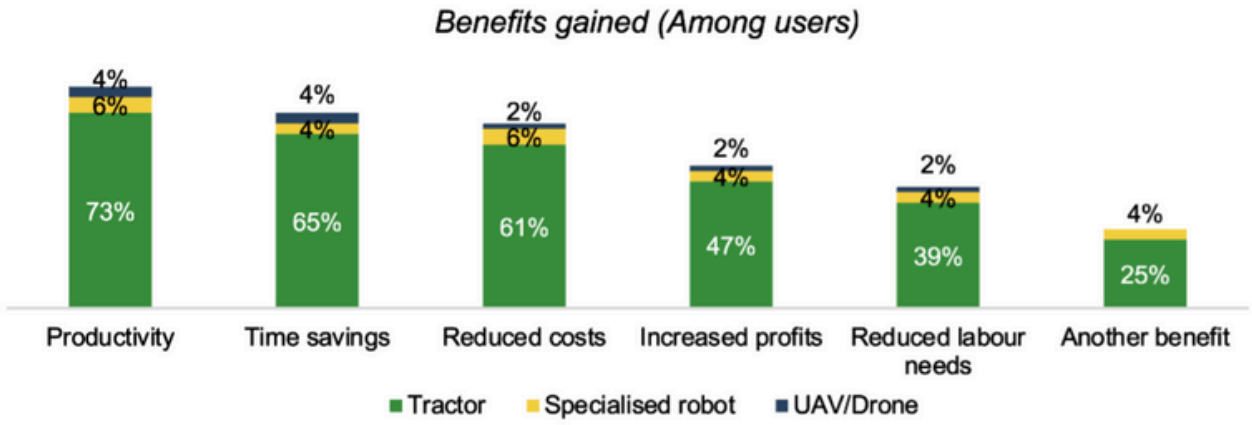
The survey aims to gain a picture of whether participants currently use any type of autonomous farm machinery on their farm. This question prompted discussion during the phone surveys as to the concept of autonomous farm machinery and what this encompasses. Technology such as GPS navigation and autosteer in tractors, sprayers, harvesters and seeders was commonly referred to in response to this question. Only eight of the participants indicated a true driverless technology was being used, detailing a spread of specialised robots, UAVs and drones.

Around one quarter of survey respondents (27%) indicated they currently use semi-autonomous farm machinery, which included tractor technology such as GPS guidance and autosteer, as the most common form used (86%).



Perceived benefits of use

The survey participants who indicated they used autonomous farm machinery, which in this survey encompassed drones, specialised robots and UAVs, or semi-autonomous technology, which predominantly included GPS, autosteer and spot spraying technology were asked to detail their perceived benefits of use. Feedback highlighted productivity (73%) and time savings (65%) as the top two benefits.



Other benefits include ...

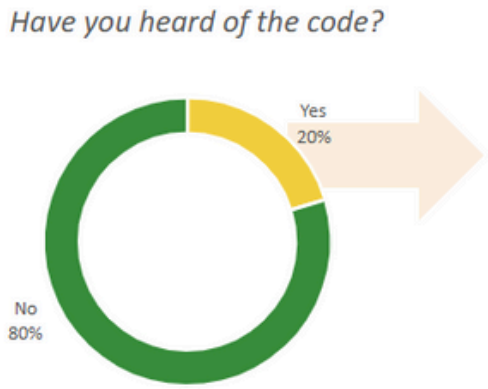
1. *Fatigue and Physical Strain Reduction*
2. *Improved Precision and Efficiency*

1. Time and Labour Savings	2. Cost Reduction	3. Safety and Fatigue Management	4. Environmental and Operational Benefits
Time Efficiency: *Enabling tasks like spraying and weed control to be performed more efficiently and potentially 24/7.* ***Labour Saving:*** *Reduce the need for manual labour, particularly for labour-intensive, repetitive tasks. Reducing operational complexities but also alleviating the challenges related to labour shortages during peak seasons.*	***Reduced Herbicide and Input Costs:*** *Optimising chemical application in turn leading to a reduction in herbicide use, chemical costs and improving sustainability.* ***Operational Cost Savings:*** *Potential savings in fuel and other operational costs.*	***Reduced Fatigue and Improved Safety:*** *Reduce the risk of fatigue-related accidents and stress, improving safety.* ***Decreased Human Error:*** *Programmed to follow precise protocols, reducing human error.*	***Environmental Benefits:*** *Wide range of environmental benefits including more accurate chemical application, lower fuel consumption, and minimised soil compaction.* ***Improved Weed Control:*** *Spot spraying or targeted weed control.*
"Efficiency - it could reduce overlap (of all operations) if I used semi-autonomous systems like GPS autosteer. And if it was fully autonomous without a driver it would enable me to perform two task at the one time."	*"I'm sure the reduction in labour and time efficiency gained particularly in spraying summer fallows would be a game changer. I'm currently very keen and closely watching the technology for this reason."*	*"I think it would be a great safety aspect as it would be a way of managing fatigue during busy times."*	*"Spot spray hard to kill summer weeds, reduction in chemical cost, better kill on the hard to kill weeds. Site specific chemical applications of pre emergent chemicals. Site specific applications of non chemical weed control options.*

Code of Practice understanding and awareness

A majority of those surveyed indicated they had not heard of the Code of Practice (80%). Of those who had heard of the Code (20%), a majority had only heard the name (71%) and were unaware of the details of the initiative.

Those who indicated they were aware of the Code, were further queried about their understanding of the Code, with themes of safety, implementation framework and regulation and responsibilities of all parties evident in their responses.



Understanding of the Code by Respondents Who Said "Yes"	
1. Innovation and Technology Development	*The need to build upon existing platforms and advance towards autonomous machinery*
2. Safety and Regulation	*Emphasis on ensuring proper safety procedures and regulatory compliance in the use of autonomous machinery.*
3. Guidelines and Structure for Implementation	*The importance of creating clear, structured guidelines and defining roles and responsibilities.*
4. Knowledge and Education	*A desire for learning more about autonomous systems and understanding best practices for their use in farming.*

ANALYSIS & INTERPRETATION

Understanding and cost are the key reasons farmers either have not adopted autonomous farm machinery or are not interested in learning more about the technology, as indicated by the feedback in this survey.

The concept of understanding presents a two-fold issue, the first being understanding of the benefits that the technology can bring to an operation and the second relates to understanding how to use the technology itself. Both versions of the theme appear to exist concurrently in most cases.

This is also a common theme in both scholarly articles and online commentary examining farmer motivations and barriers to the adoption of practices, technology and machinery in Australia.

There is also a need to clearly define the term autonomous farm machinery and the technology related to this term within messaging and educational materials, as this ambiguity could affect the way farmers engage with and make decisions about using this technology in their own operation.

Accessibility is also a concern in relation to connectivity issues in rural and remote Australia as many struggle to have reliable mobile and internet service.

The feedback from those utilising semi-autonomous technology and true driverless autonomous farm machinery centres around the practicality of efficiency and profit, highlighting a motivation that can feature in content and communication on the topic of adoption. However, it is clear that this messaging will need to explain in detail the immediate benefits for their operation and how the long-term benefits of adoption play out over time.

RECOMMENDATIONS

Industry Education & Outreach
To improve understanding, the industry should focus on clearer definitions and tailored educational initiatives. Training should include field demonstrations, online courses, and partnerships with industry groups such as GRDC and machinery dealers. Increasing engagement through industry conferences and digital platforms will further promote awareness of the Code of Practice and regulatory requirements.

Financial and Policy Support
Government and industry stakeholders should explore financial support options which could include subsidies or incentives and grants. Creating and providing farmers with financial tools, such as return on investment calculators and decision-making frameworks, can help demonstrate the long-term cost benefits of autonomous machinery.

Infrastructure and Technology Readiness
Improving rural internet and satellite connectivity is essential for expanding autonomous technology use. Industry collaboration with providers and policymakers can help bridge connectivity gaps. Additionally, establishing standardised interoperability between autonomous machinery and existing farm equipment will ensure seamless integration and scalability for farmers transitioning to autonomous systems.

Monitoring and Future Research
To track progress and industry readiness, regular surveys should be conducted to measure adoption trends and evolving challenges. Documenting case studies from early adopters can provide real-world insights into the benefits and practical applications of autonomous technology. Further collaboration with international research institutions could ensure Australian producers remain competitive and informed about global advancements.

CONCLUSION

Financial and knowledge barriers highlighted in this report should be targeted to increase adoption and understanding of autonomous farm machinery in Australia.

Policy and advocacy support to make autonomous technology accessible in financial and infrastructure effectiveness will be crucial to supporting adoption into the future.