

## Understanding and developing farmers' adaptive capacity to effectively extend research results and achieve practice change

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**Abstract.** To understand the processes and implications for adaptive management and practice change, evaluation has been built into all stages of the *Grain and Graze 2* program. A national benchmarking survey was conducted on farmers' practices as well as their perceived vulnerability, resilience and sources of influence in making decisions. An example of how this information was used will be illustrated with a case study of the activities in Western Australia. The approach was based on relevant practices for the region and the benchmark results for the knowledge, attitudes and skills of farmers and advisors. The key lessons from this work to date are that in order to have effective extension and engagement it is necessary to gain an understanding of the potential audience, use and promote adaptive management principles, and take a tailored approach to increase informed decision making and the uptake of practices.

**Keywords:** adaptive management; practice change; decision making

### Introduction

Australian farmers operate in a complex and constantly changing environment, subject to pressures from weather, markets, social change and environmental conditions. There is an increasing focus on farmers' resilience and adaptive management capacity to improve decision making and management in response to uncertain and changing conditions. *Grain and Graze 2* is a A\$12 million, four year program (ending in 2013) aimed at encouraging practice change on mixed farming enterprises to improve productivity, profitability and sustainability. It is funded by the Grains Research and Development Corporation and the Department of Agriculture Fisheries and Forestry's Caring for our Country program. *Grain and Graze 2* is currently implemented across seven regions of Australia, with research and extension conducted by a range of groups including service deliverers, research groups and industry groups. Information from the new and existing research has been communicated through materials developed for events such as workshops, field days, discussion groups and websites.

The *Grain and Graze 2* program focussed on seven topics of research and each region chose an appropriate mix of these. The topics were to do with: stubble retention, land use, the use of perennials, stocking rates, crop rotation, water budgeting and integrated weed management.

This paper explains the approach that was taken to bring about practice change in *Grain and Graze 2*, the methodology used to evaluate the results of that approach and some preliminary results.

### **The approach to practice change in *Grain and Graze 2***

The overarching aims of the *Grain and Graze 2* program are to achieve the following outcomes:

1. Improve whole-farm profitability, sustainability and groundcover by accelerating the adoption of key management practices and technologies.
2. Enhance the resilience of mixed farming businesses because farmers are better equipped to make complex decisions in relation to changing climatic, market and natural resource management challenges.

A key component of *Grain and Graze 2* is to bring about change by building farmers' and advisors' capabilities in decision making and adaptive management. This includes an improved understanding of what farmers do with regard to managing risk, seeking out information, making informed decisions, trialling new methods and reflecting on the outcomes.

Adaptive management and decision making was incorporated through two approaches of *Grain and Graze 2* program delivery; first, through extending the results of research from the seven practice change areas and second, through building the decision-making capabilities and skills of farm managers and advisors. National and regional coordinators considered this component of the *Grain and Graze 2* program as innovative and risky in terms of delivery and measuring its performance. However, it was felt that it would be particularly beneficial for farmers and advisors. It is assumed that good decision-making skills contribute to resilience.

### **Resilience thinking and adaptive management**

Resilience thinking is a framework for considering the ability of an individual, organisation or sector to prepare for and respond to shocks. It involves understanding the vulnerability (i.e. the risk, likelihood and consequence) of various external shocks (e.g. market and climatic), and one's preparedness or flexibility in terms of responding to a new state after that shock. Resilience is defined as 'the capacity of a system to absorb disturbance; to undergo change and still retain essentially the same function, structure and feedbacks' (Walker and Salt 2006, p. 32). In relation to resilience, risk and uncertainty are fundamental considerations that need to be understood. Individuals perceive risk differently (often negatively) and have different tolerances for risk. Risk is typically also associated with opportunity: higher levels of risk on the one hand can be mirrored by greater returns on the other. Both risk and uncertainty need to be understood and incorporated into on farm decision making.

In their review of the literature addressing sustainable farming systems, Darnhofer et al. (2010) identified three strategies that strengthen the adaptive capacity of a farm:

- Learning through experimenting and monitoring the outcomes, where farms are understood to be learning systems that generate and integrate new knowledge to ensure their survival and growth
- Ensuring a flexible farm organisation to increase the options for new activities by the family farm, which includes both operational or short term flexibility when facing surprises and strategic flexibility directed at long-term choices and the capacity to change the structure, resources and competencies of the farm to respond to changes in the environment.
- Diversifying the spread of risks and creating buffers, or by having a repertoire of alternative options.

The mindset needed for to be reliant is similar to that to be empowered. The research done by Coutts and Roberts (2011) in 2007 found that empowerment was about recovering after failure and turning goals into reality. Being empowered required individuals to be proficient in at least six skills and these are reflected in the literature quoted above. The skills include: networking, high order communication, planning, critical/creative thinking, being empathetic and leadership.

Adaptive management is 'a cyclical process, relying on the results of prior actions to inform future decisions' (Argent 2009, p. 13). It requires that planning and management be flexible and innovative enough to learn from local people and environments, to gain from past experience and to respond to changes quickly and wisely (Mog 2006). It is through this process of responding quickly that one is able to hasten the recovery process – and often this is interrelated with improved readiness as well.

Fazey and Schultz (2009) describe an adaptive management process as one that involves:

- Actively seeking new ways of doing management
- Actively trying to work out what happened through that management
- Actively evaluating how things might be done differently, either to improve management outcomes or to improve what can be learnt about the system being managed.

### **Methodology for evaluation**

A benchmarking study for the *Grain and Graze 2* program addressed two research questions: 'What were existing practices?' and, given that this was at the beginning of the program's implementation, 'What were the lessons and recommendations for program design and delivery?'. For the benchmarking study, the two stakeholder groups (farmers and advisors) were surveyed. The survey included a random sample of farmers with mixed enterprises, and a selected number of advisors who were expected to facilitate practice change in the longer term. Surveying occurred between August and October 2010.

In total, 2,407 farmers with mixed enterprises were surveyed as part of this benchmarking study. The contact details for the farmers came from a random sample of a database that included over 130,000 Australian farms. This data base was disaggregated into the relevant livestock and cropping industries, with contact details being provided for those that had been identified as:

- Livestock: wool, sheep, sheep stud, beef, cattle stud, alpaca and or other livestock
- Cropping: broadacre, winter cereals, oilseeds, sorghum, maize/corn, stockfeed, pasture, and or legumes.

The survey was carried out by telephone. All interviewers followed a standardised questionnaire and were briefed about the program. Data were collated through the online survey management

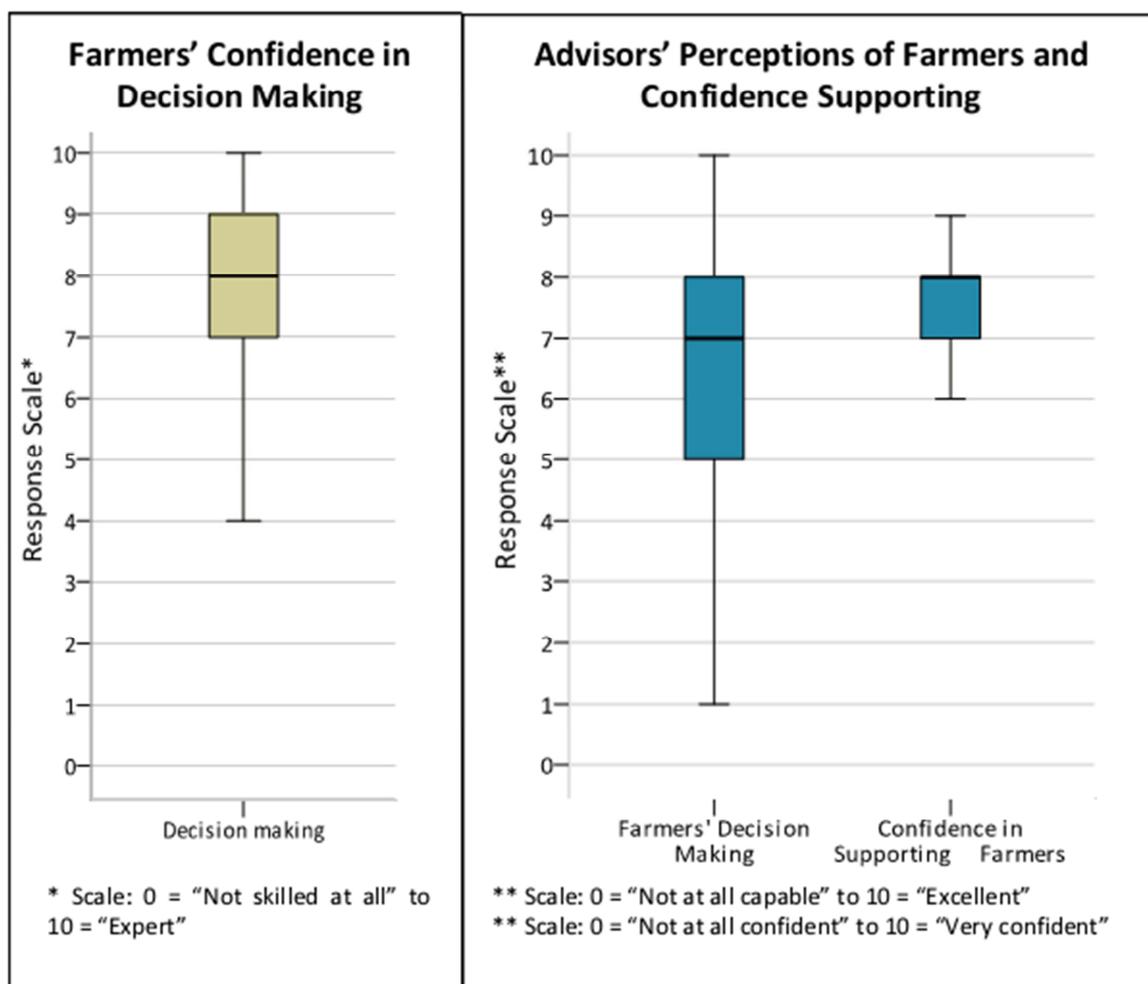
system *SurveyMonkey* to ensure data accuracy and consistency. The questions addressed the farmers’ knowledge, attitudes, skills, and aspirations in relation to the seven practice change areas. Data about their decision making skills and perceived vulnerabilities were also collected.

In total, 155 advisors nationally and across various disciplines were also surveyed. The contact details for advisors were provided by the regional program managers and added to by a snowballing technique – that is, asking if there was anybody else who should respond to this survey. Advisors were asked about their confidence in providing advice in the seven practice change areas, what they thought their clients’ level of knowledge was, the vulnerabilities of a mixed farming enterprise in their region and their perceptions of how farmers make decisions about complex matters.

**Results**

The results relevant to adaptive management and decision making are discussed first before examining how the results were used in the WA project activities. From the survey data, farm managers and advisors were particularly confident in making complex decisions; both with median scores of 8 out of 10 (see Figure 1). However, it is important to note that confidence and perceptions do not necessarily translate to capabilities. Interestingly, advisors rated farmers’ decision-making abilities somewhat lower with a median of 7 and more scores in the lower end.

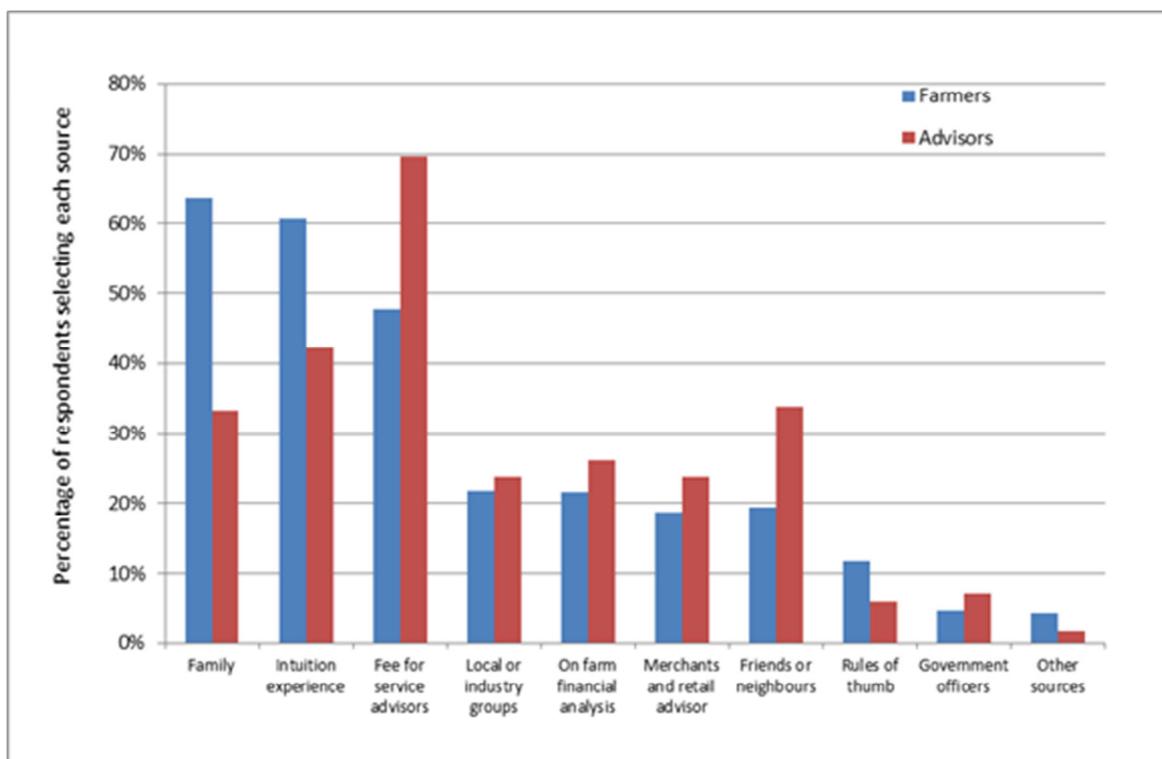
**Figure 1. Confidence of farm managers and advisors in making and supporting major on farm decisions**



It was found that there was significant variation in terms of the influences on decision making. As can be seen in Figure 2, the most common sources of influence were family, intuition or experience, and fee for service advisors. The other sources of influence were much less common. Advisors’ perceptions of influences on farmers’ decision making was quite different in that they rated the influence of advisors as much higher (70%). The perceived influence of

family and intuition or experience were substantially lower in turn. Table 1 breaks this down further by showing the percentage choosing each option based on whether the respondent chose 1, 2, or 3 of the possible options. Those who were influenced by a greater diversity of people and processes relied less on their own intuition or experience; while those with fewer influences tended to make their own decisions without as much input from external people or processes (see Table 1).

**Figure 2. Influences on farm decision making according to farmers and advisors.**



The information was available to the regions to adjust their extension activities to accommodate the strengths and weaknesses in their client groups (farmers and advisors). In addition, an important aspect to adaptive management was for farmers to trial the results of research. Three years is not a long time for research to be carried out and results to become available, therefore, to ensure that some change would be evident at the end of three years, two recommendations were made. The first was to involve the farmers in the research so that they could provide immediate feedback about the research and second, if farmers were not part of the research, then use active rather than passive methods of extension to accelerate uptake. Active methods include on farm trials (the problem solving/technology development model of extension of Coutts and Roberts 2011) with groups of farmers, rather than passive methods such as providing fact sheets.

There were follow ups every six months with the regional coordinators to see where they were at with the extension given that each region had targets to meet. Almost all regions were aware of the tight timelines and well on the way with their activities. The second survey will show what change has occurred. Results are in but not available for reporting at this stage.

**Table 1. Responses by option according to the number of options chosen: 1, 2 or 3**

		Family	Intuition experience	Fee for service advisors	Local or industry groups	On farm financial analysis	Merchants and retail advisor	Friends neighbours	Rules of thumb	Government officers
<b>1</b>	Respondent No.	42	61	17	4	7	13	5	1	0
	Respondent %	27%	39%	11%	3%	5%	8%	3%	1%	0%
<b>2</b>	Respondent No.	141	156	111	30	27	37	30	22	12
	Respondent %	49%	54%	38%	10%	9%	13%	10%	8%	4%
<b>3</b>	Respondent No.	1349	1245	1020	492	487	399	432	260	102
	Respondent %	69%	64%	52%	25%	25%	20%	22%	13%	5%
<b>Advisors</b>	Respondent No.	56	71	117	40	44	40	57	10	12
	Respondent %	33%	42%	70%	24%	26%	24%	34%	6%	7%

### Case study of utilisation of benchmark in Western Australia

Monitoring of activities, the outcomes and impacts of the program occurred at the regional level, and were collated to give a national perspective. The overall goal of the monitoring and evaluation process was to identify: what has worked for the projects in *Grain and Graze 2*; the impact on decision making and on resilience of participants; and to show the legacy of the project given its potential to influence not just GRDC but also the wider extension field. This case from Western Australia shows how the benchmarking study influenced the delivery of the extension service.

The WA *Grain and Graze 2* region has a number of important features:

- There are 1782 grain enterprises (with sheep or beef); 640 livestock enterprises (with winter cereals); 2793 mixed enterprises; 5215 total. (359 sampled in benchmarking study).
- 20% of the national target enterprises are in WA.
- WA has the largest enterprises (1000ha or greater) of all the regions, and along with EP, those over 5000ha.
- The grain industry is larger than the livestock industry in terms of size and the value of production. The cropping industry comprises of cereals with legumes, oilseeds and hay.
- Nationally the value of livestock (47%) and cropping (53%) production have been relatively equal over the past 10 years.
- WA has a greater ratio of crops to livestock, with approximately 70% cropping; consisting of about 8 million hectares.
- WA has a total of 30,922,503ha of mixed enterprises (85% of farmers); 6,828,901ha of pasture; 10 616 450ha of cropping; 600 613ha crops grazed; and 1 178207ha of legumes.
- Livestock enterprises make—up about 10% of farm profits in most businesses across the State.
- There has been a significant decline in sheep numbers over the past ten years.
- WA has the largest proportion of younger farmers (23% less than 40). There is so far no correlation to survey responses which indicate that young farmers are any more likely to change or look for change than their elder compatriots.

The adaptive management component of the WA project had two main targets:

1. To increase the capability and confidence of 100 farmers to make complex decisions that integrate enterprises to enhance profit and sustainability (100 farmers and 20 advisors are more capable and confident to make complex decisions that better integrate crop and livestock enterprises and enhance profit and sustainability).
2. To increase the capacity of nine advisors to support farmers making complex decisions.

The principles of adaptive management were used to guide the design and delivery of the extension activities. The approach taken was intended to be:

- based on an understanding of those involved
- personalised and flexible
- tailored to a range of different learning styles and personalities
- based on farmer oriented, oral information as well as research
- grounded in extension theory.

The aim was to promote informed decision making based on information seeking and sharing and trialling new methods. The responsibility was to provide both positive and negative information on a technique or technology to allow farmers to make an informed decision as to whether it fits in their farming system. It was also important to engage with issues of risk and uncertainty and how to understand these in making complex decisions.

In WA, four of the practices were targeted. These were grazing crops, summer sowing of legume pastures, pasture cropping and stubble management. For each of these, the benchmarking results showed farmers' current perceptions of the appropriateness of the practice, their confidence in using it, and the likelihood of them adopting it. This helped to identify where change could most effectively be focused, based on who the target audience was and their level of knowledge and motivation at that point.

Based on the Sustainable Grazing Systems (SGS) Farm Change Model, the approach was to develop three levels of activities aimed at farmers who were in different stages of adoption, as identified in the benchmarking report (Roberts 2010). The first level was designed to assist with the motivation stage and consisted of running paddock walks, speaking at field days and crop updates, and producing 'top tips'. The second level was aimed at assisting in the exploration and trialling stage and consisted of workshops and 'form guides' to how particular technologies or practices would be implemented at the farm level. The third level assisted at the farm practice change stage. This involved running forums to produce research/extension recommendations and creating networks of interested farmers, agronomists and researchers across the state. For each event, farmers and researchers have helped to develop the form guides. This helps to ensure the relevance of the information to the industry as well as delivering it in language that is accessible to farmers, rather than being overly scientific or technical.

An example of the lower level activities aimed at increasing knowledge and motivation was to do with grazing crops. The focus was on the bottom quartile of respondents, that is, those who were least likely to graze their crops. Advisors also reported low levels of confidence in advising on this practice, although they were interested and likely to learn more about it. The resulting strategy placed an emphasis on simple messages, lots of paddock walks, demonstration sites, and crop update presentations. There appears to be some success in this area, as advisors are now driving the process, showing an increase in confidence in this field, and they are now promoting the practice in new, lower rainfall areas.

The pasture cropping project, in contrast, focused on those who were already motivated to adopt the practice and were able to do so by cropping over perennials that already existed in their farming systems. This project worked closely with demonstration sites, addressing barriers to adoption and providing ideas on pasture varieties, suppression/control, and cropping options. Two successful forums were also held, generating industry development ideas and providing opportunities for the formation of networks.

Adaptive management was also explicitly promoted through a number of methods. One example is the capacity building of agricultural advisors through training in the @RISK software. This allows a greater opportunity to understand farmers' personal appetite for risk, and how to present risk and opportunities coherently for making farm business decisions. One key difference of this approach is representing risk on a probability curve rather than looking at averages. For example, choosing certain management options may give a 20% chance of running a loss, or one year out of five. Farmers can decide on this basis whether the risk is too great for them personally, or if they can absorb that level of risk with the associated upside probabilities. Feedback from participating advisors is that presenting risk on a distribution curve gives a clearer picture of the risk involved.

## Conclusions

The case study gives an example of how a tailored approach was taken, based on benchmarking research. Data are currently being analysed at a national level on the level of practice change as well as changes in decision making and adaptive management. Nonetheless there is emerging

evidence to support this approach to extending research, based on an understanding of the target demographic and appropriate methods to support their stage of knowledge, skill and motivation. Furthermore, building social research into the project allows not only the initial understanding of the audience interests and needs, but allows us to test the assumptions of how successful the approach has been and allow for future modifications.

While the impact study and detailed evaluations for each region will provide further evidence of the effectiveness of the approaches taken, there are a number of key lessons from this work to date. The value of benchmarking and understanding the knowledge and motivation of potential participants is obvious in informing the design of extension and engagement activities. By understanding the current level of interest and where barriers exist, activities can be pitched at the appropriate level. Furthermore, integrating and promoting adaptive management principles are showing promising results both in engagement and the uptake of practices being promoted.

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