

# The barriers to further adoption of organic farming and genetic engineering in Australia: views of agricultural professionals and their information sources

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## Abstract

Research has shown that agricultural professionals are one of the major influences on farmer adoption of agricultural innovations. Genetic engineering and organic farming represent two vastly different innovations in agriculture, and both assert to have important sustainability outcomes. This paper presents the views from a telephone survey of agricultural scientists, extension officers and academics in Australia ( $n = 185$ ) on the barriers to further adoption of organic farming and agricultural genetic engineering, as well as exploring where they obtain their information about the two innovations. Many professionals believe that market issues (in terms of small market size and the extent that consumers are willing to pay premiums) will limit the size of farmer adoption of organics in Australia, while on-farm issues (in terms of production difficulties and pest and disease problems) are named as the second largest barrier to further adoption. On the other hand, professionals from the targeted sample, who were more knowledgeable about organic farming, named information needs and lack of government support as the major barrier facing further diffusion of organic farming. In contrast, public attitudes and negative media portrayal are named as the largest barrier facing further adoption of genetic engineering in Australia. The uncertainty surrounding the research into genetic engineering (and the lack of long-term research) is believed to be the second largest barrier facing further diffusion of genetic engineering while market problems are seen as the third largest barrier.

**Key words:** organic farming, genetic engineering, agricultural professionals, barriers, information sources, technology adoption

## Introduction

Organic farming and agricultural genetic engineering represent two innovations that may hold benefits for increased sustainability in agriculture, and therefore it is important to understand what barriers their future adoption may face. Although there has been considerable research conducted by economists, sociologists, anthropologists, educationalists and marketers into what influences the adoption of innovations in agriculture<sup>1–6</sup>, there has been less work so far in looking at what influences sustainable farming techniques, or in particular, organic farming and genetic engineering products. This paper reports agricultural professionals' views on the barriers towards further adoption of organic farming and genetic engineering.

One of the main themes from the adoption literature is that adoption of sustainable techniques by landholders depends on their perceptions that the innovation will help serve their goals. Perceptions of issues are likely to vary between farmers, and they are unconsciously influenced in their selection, organization and interpretation of information via communication channels and social networks. Research shows sources that provide information to farmers about sustainable innovations have a very consistent and important influence on the adoption of innovations<sup>3–4,7</sup>. Sources that provide information about agricultural innovations to farmers include extension officers, scientists and academics. These professionals also play an important role by helping design policy to eradicate (or enforce) barriers to further diffusion of

innovations. It is therefore important to know what professionals' beliefs are on the barriers to new innovations in agriculture, especially for innovations such as organic farming and genetic engineering, as much research tends to focus on farmers' beliefs<sup>8</sup>.

Previous research by Duram<sup>9</sup> on what influences the adoption of organic agriculture has identified four key structural factors, namely: (1) economic: markets, agribusiness and independence, production costs and current level of organic farmers; (2) political: organic certification, agricultural policy and information sources; (3) social: family, human health, views of organic and conventional agriculture in society, social culture and environmental attitudes and (4) ecological: ecosystems, soil health and animal health. Lampkin and Padel<sup>10</sup> and Padel *et al.*<sup>11</sup> suggest that there are four key factors that drive (or hinder) the adoption of organic agriculture: (1) policy signals from government and other policy-related institutions; (2) market signals from consumers and the food industry; (3) access to information and (4) the removal of institutional blockages or antagonisms.

The Organic Farming Research Foundation (OFRF) in the United States has regularly surveyed organic farmers on issues surrounding organic farming. One of the questions they asked in 1995 (945 farmers surveyed) was what was seen as the greatest barrier to further organic conversion. Sixty-three percent of respondents named 'unco-operative or uninformed extension' officers<sup>12</sup>. In OFRF's 1998 national survey of organic farmers, the greatest barriers to organic farming included:

1. unco-operative or uninformed extension agents (24%);
2. cost of organically allowed inputs (20%);
3. distance or transport of organically allowed inputs (18%);
4. sourcing or finding organically allowed inputs (12%);
5. achieving desired yields (12%);
6. information on organic practices unavailable or hard to find (8%);
7. effectiveness of organically allowable inputs and methods (8%);
8. pressure from lenders to farm conventionally (8%);
9. personal lack of knowledge about organic practices (7%) and
10. social pressure from other farmers or community to farm conventionally (7%)<sup>12</sup>.

These responses were not just limited to organic farmers in the US, there were other indications that Australian farmers felt very similarly about information barriers to organic farming in Australia<sup>13</sup>. Organic farmers clearly perceived information constraints (which is a supply constraint) as one of the largest barriers towards further organic adoption. Demand constraints (such as the need for a market or higher consumer willingness to pay for organic produce) were not mentioned; however, a variety of supply constraints were often named. Costs, yields and issues about obtaining organic inputs concerned over half of the farmers who responded.

Some research has been conducted on the perceptions of genetic engineering by consumers and the barriers towards its further diffusion<sup>14,15</sup>. Consumers' lack of willingness to pay for genetically engineered products (such as genetically modified bread or meat) is usually named as the number one constraint against the further adoption of genetic engineering<sup>16</sup>. The reason for consumers' negative attitude is commonly perceived by scientists as a lack of consumer knowledge<sup>17</sup>. This popular belief of scientists about the lack of consumer knowledge has been addressed in many studies<sup>18,19</sup>. The main conclusion from these studies is that although an increase in subjective knowledge does tend to lead towards more positive attitudes to biotechnology products, actual knowledge on the other hand is not a factor in significantly influencing views. Indeed, there are a number of scientists who have serious concerns about the health risks and consequences of eating genetically engineered food, and who point to the growing number of scientific studies that are finding evidence to support their concerns<sup>20</sup>.

However, many scientists remain convinced that there are no health risks from eating genetically modified food and blame the media as the reason why consumers form negative opinions. Cronin and Jackson<sup>21</sup> interviewed a number of scientists about their views on the barriers towards further diffusion of genetic engineering. Scientists have often suggested that attitudes are linked to information sources. Be that as it may, writers have found clear differences between information sources used by conventional and organic farmers<sup>22-24</sup>. It has been found that organic and biodynamic farmers place more importance on books, organic institutions and other farmers than conventional farmers, while conventional farmers place more importance on government and conventional organizations<sup>22</sup>. Egri<sup>22</sup> concluded that both organic and conventional farmers tended to use information that supports and confirms their pre-held existing practices and biases. There has been little study on the information sources used by agricultural professionals in Australia, and this study explores the issue further. In addition, the aim of this study is to establish and compare the views of Australian public agricultural professionals on the barriers to further diffusion of genetic engineering and organic farming in Australia.

## Methodology

A telephone survey was conducted in mid-2004 to elucidate a range of agricultural professionals' views on organic farming and genetic engineering. An agricultural professional was strictly defined as either providing agricultural advice to farmers; conducting agricultural specific farm research; or teaching agricultural courses at university. Hence, those surveyed included extension officers, researchers, scientists and academics. The sample frame for the survey consisted of two groups: one general and one targeted. The general group of agricultural professionals

was limited to State and Commonwealth bodies based in South Australia. These included Rural Solutions South Australia, the South Australian Research and Development Institute, the University of Adelaide, CSIRO Land and Water, CSIRO Plant Industry and Primary Industries and Resources South Australia. The targeted group was randomly sampled from a constructed database of professionals employed within public bodies across Australia who had actual organic agriculture experience (people were surveyed from the above named organizations as well as CSIRO, University of New England, University of Western Sydney, DPIWE Tasmania, DPI Victoria, DPI Queensland, NSW Agriculture and Department of Agriculture WA).

Survey personnel were randomly selected from each database until the minimum sample sizes were reached. In the general sample 119 professionals were randomly surveyed and 66 professionals were randomly surveyed in the targeted sample. The 185 interviews conducted with professionals represented an overall response rate of 96% and were statistically representative (using a 7% level of precision). For more detail on the survey method and general statistics of respondents, see Wheeler<sup>25,26</sup>.

This study reports the answers by professionals on what they perceived as the main barriers to the further adoption of genetic engineering and organic farming in Australia, and what they named as their information sources on each innovation. Within the survey, there were two sections, one on organic agriculture and one on genetic engineering. Within these sections, professionals were asked:

What do you think are the major barriers facing the further diffusion of organic farming (*or genetic engineering*) in Australia?

There was no prompting of responses by professionals with the provision of possible answers. A professional was free to respond with as many, or as few, barriers as they wished. Similarly they were free to provide one word or extensive discussion in their responses. The wide variety of barriers named by professionals was then divided up into five categories each, to allow for comparison between agricultural innovations and survey samples. The exact response by professionals is listed after each category in Tables 1 and 2. Some typical comments made by professionals are also detailed to help provide more information and understanding about their opinions.

After answering a variety of questions on genetic engineering and organic farming, professionals were then asked:

What are the main sources where you have gained your knowledge of organic farming (*or genetic engineering*) from?

Again, there was no prompting of responses, and professionals were free to respond with as many, or as few, information sources as they wished. Most named two to three information sources.

## Results

### *Beliefs about the barriers to the further diffusion of organic farming*

The commonly cited barriers to further adoption of organic farming included market issues, on-farm issues, information needs and government support and farmer acceptance.

Respondents from the general sample were more likely to think that market issues (in terms of the size of the organic market) was the major barrier that hampered further diffusion of organic farming. A common response was that the willingness of consumers to pay for organic products was low. For example:

*'The adoption of either organics or biotechnology will be driven by the market—they will determine whether it is accepted or not'.*

Unlike general respondents who saw the barriers as predominantly demand driven, targeted respondents tended to view the barriers to the adoption of organic farming as predominantly supply driven. They were much more likely to view information needs and the lack of government support as the major issue hindering further diffusion of organic farming. Many suggested that farmers who are interested in converting to organic farming need to have more help to do so (in terms of information provision, specialist extension support, farm demonstrations and policy support). For example:

*'The biggest problem is the lack of government support for organic agriculture ... Government is completely schizo about the whole area of organics, whereas biotechnology is actively funded'.*

*'Farmers need a lot more skills to farm organically than conventionally, it is more physical and needs more technical support'.*

*'There are huge learning curves associated with converting, and farmers need a lot of information to be able to do so'.*

On-farm issues (in terms of farm profitability, economics, pest and disease management, animal health, etc.) was seen as the second largest barrier to the adoption of organic agriculture by both groups, although the general group viewed it as more critical than the targeted group.

*'Organic farming is uneconomic, it is more risky and less reliable'.*

*'Organics is simply not sustainable, hence will not be adopted by most farmers'.*

Issues associated with farmer acceptance of organic farming were named as the fourth largest barrier towards its further adoption. Of the remaining barriers named, some professionals lambasted the organic industry itself as being a barrier to further farmer adoption:

*'The organic industry is a fragmented industry, with organic agriculture being a bit of a club ... only for insiders'.*

**Table 1.** Barriers named by professionals towards further adoption of organic farming (OF).

Barriers	Total % ( <i>n</i> = 185)	General sample % ( <i>n</i> = 119)	Targeted (OF experienced) % ( <i>n</i> = 66)
<b>1. Market issues</b>	27.2	33.9	18.7***
Lack of consumer willingness to pay premiums	14.8	19.6	8.8
Lack of consumer knowledge/education	2.3	1.6	3.1
Small market/marketing issues	7.5	11.4	2.6
Small scale issues	2.5	1.2	4.1
<b>2. Information needs and Government support/policy</b>	27.2	20.8	35.2***
Large information needs	13.5	12.2	15.0
Lack of research and development	6.4	3.3	10.4
Conversion costs	2.5	2.4	2.6
Lack of extension/advice for OF	1.8	0.0	4.1
No overall research body or support	1.6	2.0	1.0
Bias from government/research bodies	0.2	0.0	0.5
Lack of practical farm demonstrations	0.2	0.4	0.0
Scientific research randomness	0.2	0.4	0.0
Misinformation from science about OF benefits	0.2	0.0	0.5
Scientific perception of OF	0.2	0.0	0.5
Training needs for agricultural professionals	0.2	0.0	0.5
<b>3. On-farm issues</b>	25.6	28.2	22.3*
Uneconomic/not profitable	13.7	18.8	7.3
Farm scale issues	3.0	2.9	3.1
Weeds	1.6	1.2	2.1
Produce appearance problems	1.1	1.6	0.5
Pest/disease problems	1.1	0.8	1.6
Lack of nutrients in organically farmed soils	1.1	0.4	2.1
Increased costs	1.1	0.4	2.1
Long-term sustainability problems	1.1	1.2	1.0
Animal health issues	0.5	0.0	1.0
Increased risk as a farming system	0.5	0.4	0.5
Difficulty in only using certified inputs	0.2	0.4	0.0
Lower yield problem	0.2	0.0	0.5
Supply chain issues	0.2	0.0	0.5
<b>4. Farmer acceptance</b>	10.3	9.0	11.9
Lack of farmer acceptance	7.1	5.3	9.3
Lack of farmer knowledge and negative perceptions on OF	1.6	1.6	1.6
Need for increased farmer skills	1.1	1.6	0.5
Organic farming has a negative image	0.5	0.4	0.5
<b>5. Other</b>	9.8	8.2	11.9
Certification issues/monitoring	3.7	3.7	3.6
Fragmented industry	1.8	0.8	3.1
Property rights issues (contamination issues, gene transfer)	1.1	1.6	0.5
Land access/suitability of land for OF	0.7	0.8	0.5
Philosophical/religious/social factors	0.7	0.0	1.6
Public good aspect—inability to capture full benefits of OF	0.5	0.8	0.0
OF as a new scientific paradigm	0.2	0.0	0.5
Globalization issues	0.2	0.0	0.5
Negative media portrayal of OF	0.2	0.0	0.5
Refusal of banks to lend money for OF	0.2	0.4	0.0
Externality issue problem for OF from other farms	0.2	0.0	0.5
OF will not feed the world	0.2	0.0	0.5

Statistical significance comparisons are only made between major barrier categories, not between sub-headings.

\*\*\* Significantly different from general sample at 1% level with a two tailed *t*-test.

\* Significantly different from general sample at 10% level with a two tailed *t*-test.

**Table 2.** Barriers named by professionals towards further adoption of genetic engineering.

Barriers	Total % (n = 185)	General sample % (n = 119)	Targeted (OF experienced) % (n = 66)
<b>1. Public attitudes and media influences</b>	40.8	43.7	36.6*
Public perception	34.9	38.9	29.2
Media portrayal	4.4	4.4	4.3
Disinformation by lobby groups	1.5	0.4	3.1
<b>2. Scientific research issues</b>	25.4	22.3	29.8
Lack of scientific research	10.5	10.0	11.2
Uncertainty of future effects	10.5	8.3	13.7
Communication of scientific info/scientists	1.5	1.7	1.2
Property right issues	1.3	0.9	1.9
Lack of independent verification	0.8	1.3	0.0
Misinformation about benefits from scientists and companies	0.5	0.0	1.2
Precautionary principle	0.3	0.0	0.6
<b>3. Market issues</b>	17.7	16.6	19.3
Overseas consumers concerns	9.0	12.2	4.3
Farmer acceptance	5.9	3.9	8.7
Losing markets	1.8	0.0	4.3
Marketing issues	0.8	0.0	1.9
Segregation issues	0.3	0.4	0.0
<b>4. Costs of genetic engineering research</b>	11.8	12.2	11.2
Political restrictions	6.7	7.4	5.6
Research costs	4.9	4.8	5.0
Low return on research and development	0.3	0.0	0.6
<b>5. Other</b>	4.4	5.2	3.1
Multinational company control	1.5	1.7	1.2
Environmental issues	1.3	1.7	0.6
Ethical concerns	1.3	1.2	1.2
Vested interests	0.3	0.4	0.0

Statistical significance comparisons are only made between major barrier categories, not between sub-headings.

\* Significantly different from general sample at 10% level with a two tailed *t*-test.

*'Australian certification agencies are completely pathetic on extension and they cannot get it together to be a proper force in influencing government'.*

*'I have wanted to do some organic research. I once offered my services (free of charge) to members in the organic industry—they declined, and did not want to know about it ... So what does that tell you about the industry?'*

A few respondents did not believe there were any barriers to the further adoption of organic farming. One such respondent said:

*'There seem to be no barriers large enough to prevent the adoption of organic agriculture in Australia. Farmers are taking it up like lemmings—and you know what happens to lemmings ...'*

Others worried about what the consequences of increased adoption of organic farming may mean for its integrity:

*'I have got reservations about organic agriculture becoming institutionalised or more mainstream—the more generalised advice that is offered then the more chance of this occurring'.*

### **Beliefs about barriers to the further diffusion of genetic engineering**

Some of the commonly cited barriers to the further diffusion of genetic engineering in Australia included: public attitudes and media influences, scientific research issues, market issues and actual costs of the research. Overall, there was virtually no significant difference between the targeted versus general samples in the barriers they perceived genetic engineering faced to further adoption in Australia; hence no differentiation between samples is commented upon.

The 'lack of consumer knowledge' and their negative attitude towards genetic engineering was one of the most cited barriers to the further diffusion of biotechnology. Consumers were viewed as not understanding the complexity of genetic engineering, and because of this lack of understanding, tended to reject the technology. For example:

*'The public perceive biotechnology as a snake oil issue. The public has a fundamental lack of understanding of biotechnology'.*

*'It is just a number of vocal luddites that spread fear of the unknown to the public'.*

Many professionals (in both the targeted and general samples) named the media as the key reason to why the public had such a negative attitude towards the technology. They believed that the media's portrayal was often inaccurate and biased against genetic engineering in general. Professionals would often cite the need for increased education of consumers to overcome the media's portrayal and to change how consumers viewed genetic engineering. For example:

*'We need increased education of the public regarding biotechnology to achieve more acceptance. At the moment there is scaremongering and misinformation and the public do not understand the technology's benefits. We need to decrease the emotional element, and provide non-biased information. However, a lot of scientists are not willing to get involved in the public debate'.*

*'There is too much bias—for either organic agriculture or biotechnology. Too much sensational reporting for either goes on ... We need to have more unbiased, independent, balanced comment on the benefits and costs of both...'*

On the other hand, some of the respondents who named public attitudes as a barrier to further genetic engineering diffusion considered this as a good thing (generally these professionals viewed genetic engineering negatively overall). These professionals questioned the conventional scientific view of the role of education in changing consumers' views and the general perception by science that consumers are ill-informed. One such response was:

*'It seems that the government believes that once people understand biotechnology more then they will accept it. But I do not understand this reasoning—I am an informed and knowledgeable scientist and I have discriminately used the technology, yet I remain sceptical about it'.*

*'Far from them being ignorant or ill-informed, the cautious approach in the farming community shows that they have very in-depth knowledge and understand the economic risks of biotechnology ... Therefore, increased education will not necessarily help them to understand biotechnology benefits, it may lead to a more positive view but it may as equally lead to a more negative view'.*

The next largest barrier named against the further diffusion of genetic engineering in Australia was scientific research issues, that is, a supply constraint. A number of professionals believed that the lack of long-term research into the technology and the uncertainty and lack of transparency surrounding much of the current research was a detriment to the further adoption of the technology. Some believed that further long-term research would mean greater certainty and reassurance about the technology's net benefits and hence lead to greater adoption. For example:

*'There is a lack of proof by biotechnology companies on the benefits of biotech products'.*

*'There is a lack of scientific data on the technology, which has led to uncertainty about future benefits and costs. The public is very mistrusting of government policy because of this lack of information'.*

The third most named barrier facing genetic engineering was market issues, a demand constraint, and one similar to the first named barrier. Some professionals believed that genetic engineering crops in Australia would prove not to have enough economic benefits because many of Australia's key export markets (such as Japan and Europe) had effectively banned imports of genetically engineered products. Others believed that segregation issues (such as ensuring the separation of genetically engineered canola from other crops) would prove to be uneconomic for farmer adoption. The fourth most named barrier was to do with the actual cost of genetic engineering research. Many professionals believed that the costs of genetic engineering research were very high, the returns low, and that political restrictions made it uneconomic. Finally, a small number of professionals named ethical and environmental restrictions as barriers facing further diffusion of genetic engineering in Australia.

### *Information sources cited for organic farming*

The previous sections have shown that professionals from the targeted and general samples named different barriers facing the further adoption of organic farming in Australia. It is therefore interesting to know whether they also named different information sources on organic farming. Table 3 illustrates the three main sources of information on organic farming named by Australian agricultural professionals.

There is a clear difference between the information sources used by general respondents and the information sources used by targeted respondents. General respondents consistently named the media/internet as their main source of information on organic farming, followed by scientific sources. Targeted respondents named the organic industry, scientific sources and organic farms/farmers as their main sources of information.

### *Information sources cited for genetic engineering*

Table 4 illustrates the three main sources of information on genetic engineering named by Australian agricultural professionals.

Unlike the results for organic farming, there is little significant difference between the information sources used by general and targeted respondents on genetic engineering. Both samples consistently named scientific sources and the media/internet as their main source of information on genetic engineering, followed by peers. Although targeted respondents were more likely to name government and

**Table 3.** Information sources named by professionals on organic farming.

Information sources	Total % ( <i>n</i> = 185)	General sample % ( <i>n</i> = 119)	Targeted (OF experienced) % ( <i>n</i> = 66)
First main source of information			
Media/internet	27.1	36.7	9.8***
Scientific sources	27.1	26.6	27.9
Organic industry	18.8	10.0	34.4***
Organic farms/farmers	14.7	15.6	13.1
Peers	12.4	11.0	14.8
Second main source of information			
Scientific sources	28.9	23.8	35.5***
Media/internet	22.5	26.3	17.7***
Peers	21.8	22.5	21.0
Organic industry	14.8	13.8	16.1
Organic farms/farmers	12.0	13.8	9.7
All other cited main sources of information			
Scientific sources	28.8	33.3	25.0**
Media/internet	26.3	27.8	25.0
Organic farms/farmers	20.0	8.3	29.5***
Peers	16.3	16.7	15.9
Organic industry	8.8	13.9	4.5***

\*\*\* Significantly different from general sample at 1% level with a two tailed *t*-test.

\*\* Significantly different from general sample at 5% level with a two tailed *t*-test.

farms/farmers as a source of information than general respondents, the actual difference was small.

## Discussion

Although agricultural professionals named demand constraints (i.e. small markets, the lack of consumer willingness to pay and consumers' negative attitudes) as the largest barrier facing further diffusion of organic farming or genetic engineering in Australia, there was a significant difference between the total amount of demand and supply constraints named for each innovation. Overall, 59% of professionals in the total sample named demand constraints facing further adoption of genetic engineering, while only 27% of professionals named demand constraints facing organic agriculture. In particular, targeted respondents (who on average were more knowledgeable about organic agriculture) were more likely to name supply constraints as their first largest barrier to further adoption of organic farming. Information needs by farmers and government support for organic farming (usually in the form of providing extension support or R&D) were seen by many as the greatest barrier to further diffusion of organic farming. In this regard, responses by targeted professionals were very similar to survey responses by organic farmers on their perceptions of the largest barriers to further adoption of organic farming.

Professionals' responses in naming a 'lack of consumer knowledge' and media portrayal of genetic engineering are also similar to the common response by the scientific

community. Many scientists argue that the public does not understand genetic engineering and that consumers' reluctance to accept biotechnology therefore stems from ignorance and not wisdom. However, as mentioned previously, consumer research does not support this theory that more knowledge will lead to more acceptance<sup>18,19</sup>. Wheeler<sup>27</sup> investigated the role of knowledge in influencing agricultural professionals beliefs towards genetic engineering, and concluded that there was no evidence to suggest that increased knowledge of professionals led to a more positive overall view. Both opponents and proponents of the technology rated their knowledge similarly. On the other hand, it was found in Wheeler<sup>26</sup> that an increase in professional knowledge about organic farming did lead to a more positive view about the innovation. All these results suggest that the link between knowledge and acceptance of an innovation is complex, and requires future research.

As mentioned previously, the media is often perceived as misinforming the public on biotechnology and sensationalizing its issues<sup>28</sup>. However, it seems that the role of the media in influencing public opinion through negative stories has been overstated somewhat, as studies have shown that genetic engineering stories in the Australian media have been generally positive (55–70%), 17–32% have been neutral, and only 13–16% were negative<sup>29,30</sup>. Indeed, agricultural professionals themselves consistently named the media and internet as a main source of information on genetic engineering, and respondents from the general sample cited it even more strongly as an information source for organic farming.

**Table 4.** Information sources named by professionals on genetic engineering.

Information sources	Total % (n = 185)	General sample % (n = 119)	Targeted (OF experienced) % (n = 66)
First main source of information			
Scientific sources	35.7	39.5	28.8
Media/Internet	35.1	37.0	31.8
Peers	21.6	20.2	24.2
Government	4.3	1.7	9.1***
Farmers	2.7	0.8	6.1**
Industry	0.5	0.8	0.0
Second main source of information			
Scientific sources	38.6	37.5	40.3
Peers	32.9	35.4	29.0
Media/Internet	17.7	20.8	12.9
Government	7.6	3.1	14.5***
Farmers	1.9	2.1	1.6
Industry	1.3	1.0	1.6
All other cited main sources of information			
Scientific sources	29.5	25.0	33.3***
Media/Internet	29.5	36.4	23.5
Peers	22.1	29.5	15.7
Government	8.4	2.3	13.7***
Industry	6.3	6.8	5.9
Farmers	4.2	0.0	7.8***

\*\*\* Significantly different from general sample at 1% level with a two tailed *t*-test.

\*\* Significantly different from general sample at 5% level with a two tailed *t*-test.

The other main perceived supply constraint against further diffusion of organic farming was seen to be on-farm issues (such as economic issues, pest and disease problems), although again, the more knowledgeable targeted sample were far less likely to see that as a barrier to further adoption of organic farming than the general sample. Respondents from the general sample generally saw on-farm and market issues as the key barriers to further diffusion, while professionals from the targeted sample generally saw information needs and government support as the key issue, but were also more likely to name farmer acceptance difficulties (changing mindsets) and other issues (such as certification difficulties, externality problems from conventional farms, etc.) as barriers.

In brief, the targeted sample seemed much more familiar with the actual practice and reality of organic farming than the general sample, and hence also tended to dismiss what is commonly perceived in the scientific community as organic farming's major problems. Wheeler<sup>25</sup> provides more background and detail on what professionals actually perceived as the major benefits and costs of each farming innovation. Responses from the targeted sample about the ranking of barriers facing future adoption of organic farming were consistently extremely similar to responses from previous organic farmer surveys. One reason for this similarity is that respondents from the targeted sample were much more likely to rely on the organic industry and organic farms/farmers as information sources than general respondents. This may reflect either that targeted

professionals have difficulty in obtaining relevant scientific evidence specific for Australian organic farming, or that they view organic farmers as being up to date with the latest research or issues surrounding organic farming as an innovation.

On the other hand, there was little difference in responses between the targeted and general samples towards the barriers towards further diffusion of genetic engineering, or in their named information sources on genetic engineering. Apart from demand constraints, many professionals named supply constraints such as the need for more research, the costs of the research, the return of the research, the transparency and lack of independent verification of some of the research, and the political restrictions on research as major barriers against further diffusion.

## Conclusion

There was a clear difference between the views towards organic farming of the targeted and general samples of agricultural professionals. The general sample was much more likely to name market issues and on-farm difficulties as the main obstacle facing further adoption of organic farming. Agricultural professionals who were part of the more knowledgeable sample were more likely to have views similar to organic farmers; that is, information needs and a lack of government support are the main obstacles facing further diffusion of organic farming.



Respondents from the targeted sample were also much more likely to name the organic industry and organic farms/farmers as key information sources on organic farming, unlike respondents from the general sample. Overall, professionals believed that supply constraints were the largest reason limiting organic farming expansion while they were much more likely to name demand constraints (such as public attitudes) as the largest barrier to further diffusion of genetic engineering in Australia. As to be expected, there was no significant difference detected between the genetic engineering views of the two samples, nor in their stated information sources (apart from slightly more reliance on farmers and government from the targeted sample). Interestingly enough, agricultural professionals named scientific sources and the media/internet as their main information sources, although the media/internet has been constantly blamed as causing negative public perceptions of genetic engineering. The similarity between the views of the targeted agricultural professionals and organic farmers themselves lend support to farmers helping shape agricultural policy changes.

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