



Farm innovation in the broadacre and dairy industries, 2006-07 to 2007-08

Bella Liao and Peter Martin

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Australian Bureau of Agricultural and Resource Economics

Postal address GPO Box 1563 Canberra ACT 2601 Australia

Location 7B London Circuit Canberra ACT 2601

Switchboard +61 2 6272 2000

Facsimile +61 2 6272 2001

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Foreword

The adoption of more efficient technologies and management practices is considered to be one of the key drivers in improving farm productivity and financial performance. The 2007-08 farm innovation survey was conducted, in addition to ABARE's annual farm surveys, to collect data on the extent of innovative change on broadacre and dairy farms over the two years ending 2007-08.

By linking responses for the farm innovation survey to farm financial performance data, the analysis contained in this report provides the broadacre and dairy industries with the opportunity to identify the characteristics of farms that made innovative changes over the period 2006-07 to 2007-08.

This report presents preliminary results of the 2007-08 farm innovation survey. Further analysis of these data will be undertaken to identify key determinants of farm innovative behaviour and the relationship between innovation adoption and productivity growth among broadacre and dairy farms.



Phillip Glyde
Executive Director
November 2009

Contents

Summary	1
1 Introduction	3
2 Survey results	4
Extent of innovative changes	4
Ranking of innovative changes	5
Adoption of innovation by farm size – family farms	8
Innovative activities by broadacre industry	8
Innovative activities by state	11
Innovative activities by level of education	14
Farm characteristics by innovative change	14
3 Farm financial performance and innovation decision	18
Innovative change for top and bottom performing farms	18
Farm financial performance and decision to adopt innovation	20
4 Conclusions	24
References	25
Figures	
a Proportion of farms adopting innovative changes: broadacre industry	6
b Proportion of farms adopting innovative changes: dairy industry	7
c Major cash costs of dairy farms	8
d Farm cash income, average per farm	20
e Rate of return, average per farm	21
f Farm cash income: broadacre industry, average per farm	21
g Rate of return: broadacre industry, average per farm	22
h Farm cash income: dairy industry, average per farm	22
i Rate of return: dairy industry, average per farm	23

Tables

1	Farms making innovative changes, by extent of innovative changes: broadacre and dairy farms	4
2	Farm size and innovative change, family farms	9
3	Farms making innovative changes by broadacre industries	10
4	Farms making innovative changes by state, broadacre and dairy farms	12
5	Innovative change by level of farmer education, broadacre and dairy farms	15
6	Farms making innovative changes ranked by rate of return, broadacre and dairy farms	19

Summary

This report presents preliminary results from a farm innovation survey conducted by ABARE in 2008 as part of the 2007-08 Australian Agricultural and Grazing Industry Survey (AAGIS) and Australian Dairy Industry Survey (ADIS).

The farm innovation survey obtained information from broadacre and dairy farmers on the extent of innovation adoption during 2006-07 and 2007-08 across a broad list of innovative activities including: product changes, new management practices, natural resource management initiatives, the introduction of new cropping equipment and machinery, and marketing of farm products.

Most broadacre and dairy farms made at least one innovative change over the two years ending 2007-08. However, there were marked differences between broadacre and dairy farms in their choices of innovative changes. The most commonly adopted activities by broadacre farmers were introducing new cropping equipment, new fertiliser practices and new soil management practices. Dairy farmers mainly introduced new irrigation and water management practices, new pasture types, and new fodder conservation and use practices in 2006-07 and 2007-08.

Within broadacre agriculture, adoption of innovative changes to farm management practices and technologies was higher among cropping farms than livestock farms. This result is consistent with cropping farms generally achieving higher productivity growth than livestock farms over time (Nossal et al. 2009).

A range of factors, including farm business size and farmer education, are significant in directly or indirectly affecting the adoption of innovation by farmers. On average, higher levels of financial performance appear to have influenced farmers' decisions to adopt new innovations, in particular capital-intensive innovations such as new cropping equipment and machinery. Adoption of many innovations, particularly those being management-intensive, is likely to be driven by a wide range of factors including behavioural factors that were not investigated in this analysis.

Innovative changes made by broadacre and dairy farms over the two years ending 2007-08 appear to have been motivated by either an improved capability to implement changes because of increased income or reduced costs of implementation, or an imperative to act because of circumstances imposed by factors including seasonal conditions and high farm input prices.

To facilitate the best longer term outcomes for farm profitability and productivity, farmers require well formed business and investment plans to ensure they make appropriate decisions in times of opportunity and are well informed on management and technology options in times of challenge.

Further economic analysis of the 2007-08 farm innovation data will be undertaken to identify key determinants of farm innovative behaviour and the relationship between innovation adoption and productivity growth among broadacre and dairy farms. In addition, ABARE intends to continue collecting similar data to monitor the effect of farmers' adoption of innovation on longer term farm productivity and farm performance.

1 Introduction

A key driver in improving farm performance is the provision and adoption of more efficient technologies and management practices (DAFF 2005).

To measure the extent of farm innovation over the two years ending 2007-08, data were collected as a supplement to the 2007-08 Australian Agricultural and Grazing Industry Survey (AAGIS) and Australian Dairy Industry Survey (ADIS). The AAGIS targets broadacre farms, that are farms growing grains, oilseeds or pulses or run sheep or beef cattle. The ADIS targets farms engaging in dairy farming. Together, the broadacre and dairy sectors account for around 70 per cent of Australia's commercial scale farms and more than 60 per cent of the gross value of Australian farm production (ABS 2008).

Innovation was defined in the survey to include the implementation of new practices or technologies that were not previously used by the farm business and which are likely to be used on a continuing basis. Broadacre and dairy farmers were asked to rank the extent to which they had adopted innovations. The extent of adoption was assessed and reported as either making little or no changes, changes to some extent or changes to a great extent. The innovations were grouped according to the type of innovation, such as on-farm production practices, new products introduced, marketing approaches, business management initiatives, labour use, natural resource management initiatives, the introduction of cropping equipment and new irrigation practices.

This report provides preliminary results from this collection and identifies characteristics of broadacre and dairy farms that made innovative changes over the two years ending 2007-08.

Further analysis of the 2007-08 farm innovation data will be undertaken for future ABARE research on total factor productivity among broadacre and dairy farms. The research will include economic modelling to identify key determinants of farm innovative behaviour and the relationship between innovation adoption and productivity growth.

2 Survey results

Extent of innovative changes

Over the period 2006-07 and 2007-08, more than 80 per cent of broadacre farms and more than 90 per cent of dairy farms made at least one innovative change to farm management practices or farm technologies (table 1). Most of the innovative changes were recorded to have occurred to some extent.

Survey results also show notable differences in the adoption of innovative changes across industries, states and farm sizes during 2006-07 and 2007-08.

1 Farms making innovative changes, by extent of innovative changes: broadacre and dairy farms, 2006-07 and 2007-08 per cent of farms

Industry		no innovative change		at least one change to some extent		at least one change to a great extent	
		%	(standard error)	%	(standard error)	%	(standard error)
Broadacre farms	%	19	(9)	48	(4)	33	(5)
Dairy farms	%	9	(30)	55	(9)	35	(13)
Broadacre industry							
Wheat and other crops industry	%	16	(21)	41	(10)	43	(8)
Mixed livestock-crops industry	%	10	(21)	54	(6)	36	(8)
Beef industry	%	27	(14)	46	(8)	26	(12)
Sheep industry	%	18	(24)	53	(9)	29	(16)
Sheep-beef industry	%	20	(20)	48	(12)	32	(16)
State							
New South Wales	%	18	(15)	47	(7)	35	(9)
Victoria	%	21	(16)	48	(8)	30	(12)
Queensland	%	11	(32)	54	(9)	35	(10)
South Australia	%	18	(32)	47	(14)	35	(12)
Western Australia	%	23	(17)	43	(11)	34	(12)
Tasmania	%	11	(66)	64	(15)	25	(26)
Northern Territory	%	27	(30)	58	(15)	15	(32)
Family farms							
Turnover up to 400k	%	23	(10)	48	(5)	29	(7)
Turnover greater than 400k	%	8	(14)	49	(4)	43	(5)
All family farms	%	18	(8)	49	(4)	33	(5)
All farms	%	18	(8)	49	(4)	33	(5)

Note: Figures in parentheses are standard errors expressed as a percentage of the estimate provided.

A higher proportion of farms (90 per cent) in the mixed livestock-crops industry made at least one innovative change, while the wheat and other crops industry recorded the highest percentage of farms (43 per cent) making at least one innovative change to a great extent.

Across all states, around half of farms made at least one innovative change to some extent over the two years ending 2007-08 (table 1). Nearly 90 per cent of farms in Queensland and Tasmania made at least one innovative change over the two years to 2007-08.

State differences in the proportion of farms making innovative changes are likely to be because of a range of factors. States and regions with a high proportion of farms operating under more complex farming systems, such as systems for both summer and winter cropping, or regions with irrigated cropping systems, may have greater opportunities or need for innovative changes.

Adoption of innovative changes is also likely to have been affected by seasonal conditions, with prolonged adverse seasonal conditions constraining the adoption of some innovations, such as changes in crop varieties, while encouraging the adoption of others, such as new irrigation practices.

The higher proportion of Queensland farms introducing innovations (nearly 90 per cent) over the two years ending 2007-08, may be related to a significant abatement in drought conditions. Relative to other states, farm production and farm financial performance improved to a greater extent in Queensland over this period. Conversely, increasingly severe drought conditions in Tasmania may have led to an increase in innovative changes, particularly in irrigation practices.

Farm business size also appears to affect the extent of farm innovation. Among the 98 per cent of broadacre and dairy farms that can be classified as family farms (defined as farms owned and managed by families), there were significant differences between large and small farm businesses in the adoption of innovation (table 1). More than 90 per cent of large family farm businesses, those with an annual turnover exceeding \$400 000, made innovative changes over the two years ending 2007-08 and more than 40 per cent made at least one change to a great extent. In comparison, 77 per cent of small family farm businesses, those with an annual turnover of up to \$400 000, made innovative changes and an estimated 29 per cent made at least one change to a great extent.

Ranking of innovative changes

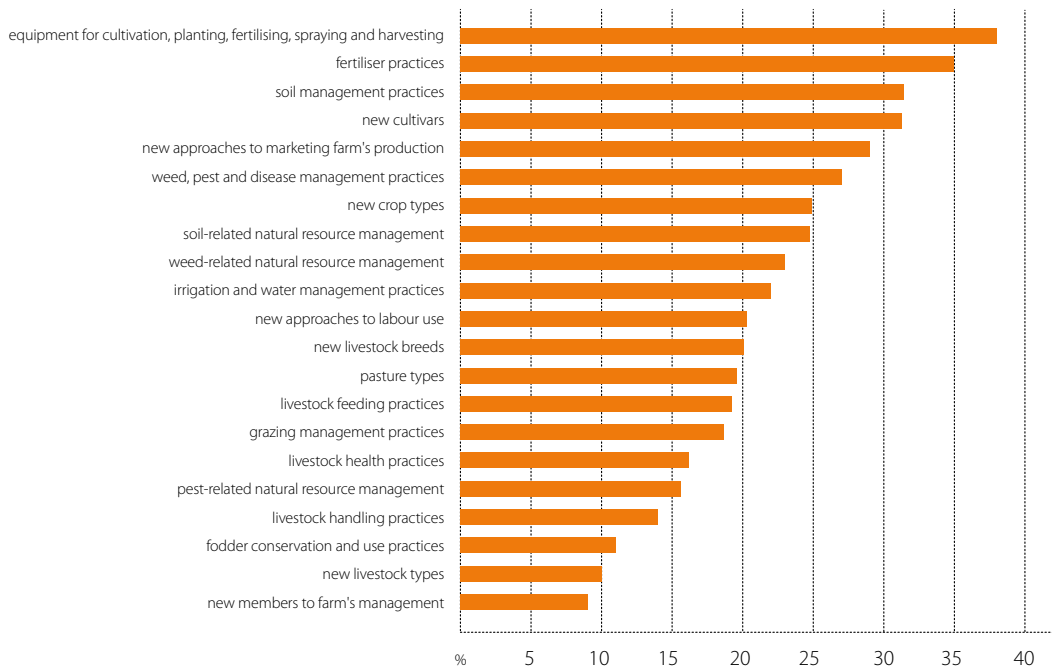
There was a marked difference in the choice of innovative changes between broadacre and dairy farms because of different farming systems for these industries.

Nearly 40 per cent of broadacre farms purchased new cropping equipment over the two years ending 2007-08 (figure a). A high Australian dollar exchange rate, particularly in 2007-08, resulted in a fall in prices for imported farm plant and machinery, and consequently an increase in machinery purchases. Additions of non-land capital by broadacre farms were near record in 2007-08 (Martin et al. 2009).

Similarly, more than one-third of broadacre farms changed fertiliser practices over the two years ending 2007-08. Fertiliser prices increased sharply during 2007-08, more than doubling for some fertilisers, providing a strong incentive for farmers to alter fertiliser application practices.

A large proportion of broadacre farms (31 per cent) reported making innovative changes in soil management practices over the two years ending 2007-08. Severely dry seasonal conditions were widespread in 2006-07 and persisted throughout most southern regions of Australia in 2007-08 (Martin et al. 2009). The continuation of dry conditions over a number of years has provided a strong incentive for farmers to make changes to soil management practices, including tillage and crop sowing practices, to generate some crop production from the limited soil moisture available.

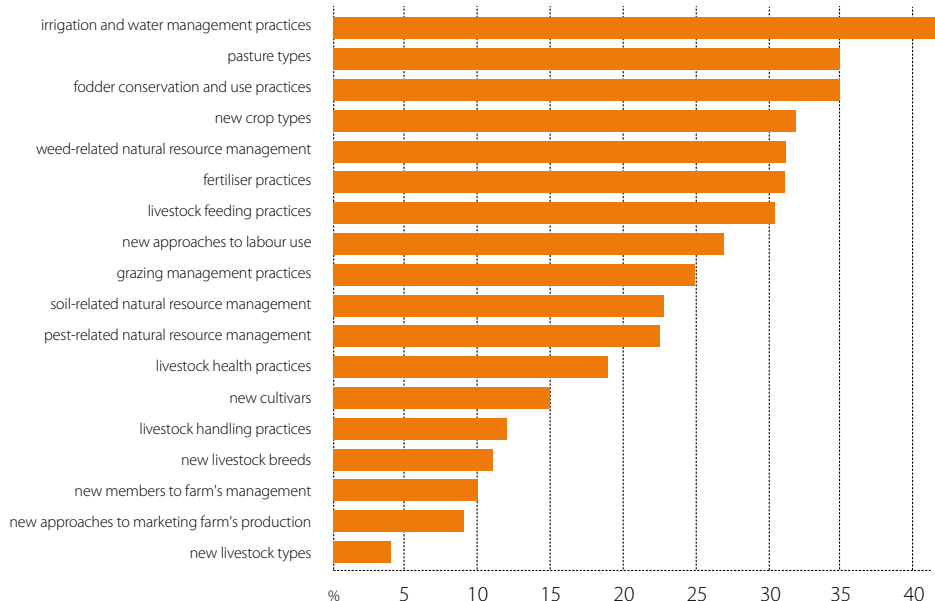
a Proportion of farms adopting innovative changes: broadacre industry



The introduction of new crop cultivars was recorded by an estimated 31 per cent of broadacre farms. To some extent, this introduction may be part of the industry-wide strategy to control diseases such as rusts in cereals. In addition, the adoption of new crop cultivars mostly involves a small incremental change in cropping technology which is easily understood and imposes relatively low risk.

Among dairy farms, the introduction of new irrigation and water management practices was the highest ranked innovative change made over the two years ending 2007-08 (figure b).

b Proportion of farms adopting innovative changes: dairy industry



Most dairy farms use irrigation water. Availability of irrigation water was severely restricted during 2006-07 and 2007-08, particularly in the southern Murray-Darling Basin. This restricted availability of irrigation water, combined with local drought conditions, provided a strong incentive for farmers to change irrigation practices during this period.

In addition, new pasture types and the introduction of new fodder conservation and fodder use practices were highly ranked innovations for the dairy industry. As with the adoption of new irrigation practices, the adoption of these innovations coincided with dry seasonal conditions and reduced availability of irrigation water, together with a large increase in prices for feed grains, hay and silage in 2006-07 and 2007-08. Expenditure on purchased fodder was the largest single component of total cash costs for dairy farms (figure c) (Hooper et al. 2008). These factors combined to provide a strong incentive to introduce new pasture management and fodder conservation practices on-farm, and changes in the use of purchased fodder. Over the longer term, managing feed inputs is an important component of productivity growth for dairy farms.

The proportion of broadacre farm businesses introducing new approaches to marketing production was much higher than that for dairy farms. Many broadacre farms produce a number of different farm products, including those which are heterogeneous and have a range of end uses through a range of market outlets. In contrast, the majority of dairy farms are reliant on the production of milk, for which few alternative market options are available.

The most commonly adopted innovations by dairy farms are different from those adopted by broadacre farms because of differing farming conditions between the two

C Major cash costs of dairy farms



Source: ABARE, Australian farm survey results, 2006-07 to 2008-09.

industries. There have been continued changes to the management practices and the adoption of various technologies by dairy farmers over the past 20 years (Ashton and Mackinnon 2008).

Adoption of innovation by farm size – family farms

Family farms predominate in the broadacre and dairy industries. It is estimated from the ABARE survey data that more than 98 per cent of broadacre and dairy farms are owned and managed by families.

For most innovative activities there was a significantly higher proportion of large family farms adopting innovation than small family farms (table 2). Around 55 per cent of large family farms purchased new cropping equipment and 45 per cent of large family farms adopted new irrigation and water management practices during 2006-07 and 2007-08.

This suggests larger family farms have a greater capability to adopt new innovations, perhaps because of higher profitability, a greater capacity to take risks or because adopting many innovations may be better suited to larger farms. In part, this difference is also likely to reflect the higher proportion of livestock (sheep or beef) farms among small farms (ABS 2008). Small livestock farms, because of their relatively simple operation and restricted financial capacity, have less incentive to adopt innovative changes.

Innovative activities by broadacre industry

In general, the adoption of innovative changes to farm management practices and technologies was higher among broadacre cropping farms than broadacre livestock farms (table 3). Cropping farms have been defined as farms in the wheat and other crops industry

2 Farm size and innovative change, family farms, 2006-07 and 2007-08

per cent of farms

Innovative activity		turnover up to 400k		turnover greater than 400k		all family farms	
Marketing							
New approaches to marketing farm's production	%	21	(10)	39	(5)	26	(5)
Management/labour use							
New approaches to labour use	%	15	(11)	33	(6)	21	(6)
New members to farm's management	%	5	(19)	19	(8)	9	(8)
Natural resource management practices							
Weed-related natural resource management	%	22	(9)	27	(7)	23	(6)
Pest-related natural resource management	%	14	(12)	21	(8)	16	(7)
Soil-related natural resource management	%	21	(9)	32	(6)	24	(6)
Product change							
New crop types	%	24	(11)	29	(7)	26	(7)
New crop cultivars	%	23	(11)	37	(6)	28	(6)
New livestock types	%	9	(14)	9	(13)	9	(10)
New livestock breeds	%	18	(11)	19	(8)	19	(8)
Production practice change							
Fertiliser practices	%	33	(9)	37	(6)	35	(6)
Soil management practices	%	27	(10)	39	(6)	31	(6)
Weed, pest and disease management practices	%	22	(11)	35	(7)	27	(6)
Grazing management practices	%	18	(10)	22	(7)	19	(7)
Livestock feeding practices	%	17	(10)	27	(7)	20	(6)
Fodder conservation and use practices	%	10	(12)	21	(8)	14	(7)
Livestock handling practices	%	12	(13)	16	(8)	13	(9)
Livestock health practices	%	14	(12)	22	(8)	16	(8)
Pasture types	%	19	(11)	26	(7)	21	(7)
Cropping equipment							
Equipment for cultivation, planting, fertilising, spraying and harvesting	%	29	(8)	55	(4)	38	(4)
Irrigation practices							
Irrigation and water management practices	%	17	(25)	45	(10)	27	(12)

Note: Figures in parentheses are standard errors expressed as a percentage of the estimate provided.

and mixed livestock-crops industry, and livestock farms as farms in the beef, sheep and sheep-beef industries. This finding of higher levels of adoption of innovation among cropping farms is consistent with the observation that cropping farms have generally achieved higher productivity growth than livestock industries over time (Nossal et al. 2009).

3 Farms making innovative changes by broadacre industries, 2006-07 and 2007-08 per cent of farms

Innovative activity		wheat and other crops		mixed livestock- crops		beef		sheep		sheep- beef	
Marketing											
New approaches to marketing farm's production	%	39	(10)	37	(9)	20	(16)	32	(18)	17	(16)
Management/labour use											
New approaches to labour use	%	22	(11)	25	(12)	14	(15)	21	(24)	27	(26)
New members to farm's management	%	13	(19)	12	(15)	5	(22)	7	(44)	12	(25)
Natural resource management practices											
Weed-related natural resource management	%	25	(16)	18	(13)	25	(15)	23	(20)	18	(19)
Pest-related natural resource management	%	18	(17)	17	(14)	13	(19)	19	(23)	10	(20)
Soil-related natural resource management	%	29	(12)	34	(9)	16	(17)	26	(17)	23	(20)
Product changes											
New crop types	%	21	(13)	29	(9)	22	(22)	34	(23)	17	(29)
New crop cultivars	%	36	(9)	38	(8)	20	(24)	27	(19)	23	(24)
New livestock types	%	7	(22)	10	(18)	10	(24)	14	(22)	11	(33)
New livestock breeds	%	11	(21)	25	(12)	21	(16)	19	(24)	24	(24)
Production practice changes											
Fertiliser practices	%	36	(10)	31	(10)	38	(21)	42	(19)	30	(19)
Soil management practices	%	35	(10)	38	(9)	16	(37)	31	(17)	27	(22)
Weed, pest and disease management practices	%	35	(10)	29	(10)	16	(34)	20	(23)	17	(25)
Grazing management practices	%	14	(24)	20	(12)	17	(16)	24	(20)	21	(26)
Livestock feeding practices	%	14	(23)	22	(12)	16	(16)	24	(19)	23	(24)
Fodder conservation and use practices	%	8	(22)	14	(15)	7	(22)	11	(22)	19	(24)
Livestock handling practices	%	14	(25)	13	(16)	15	(17)	14	(30)	13	(20)
Livestock health practices	%	9	(28)	22	(13)	14	(17)	18	(25)	20	(23)
Pasture types	%	11	(29)	22	(13)	23	(15)	17	(18)	24	(17)
Cropping equipment											
Equipment for cultivation, planting, fertilising, spraying and harvesting	%	47	(8)	41	(8)	22	(27)	38	(14)	30	(19)
Irrigation practices											
Irrigation and water management practices	%	29	(30)	44	(19)	14	(47)	11	(70)	22	(55)

Note: Figures in parentheses are standard errors expressed as a percentage of the estimate provided.

The mixed livestock-crops farms had the highest proportion (44 per cent) of farm businesses in any broadacre industry adopting changes to irrigation and water management practices and more than 40 per cent of mixed livestock-crop farms adopted some new cropping equipment in the two years ending 2007-08.

Changes to cropping equipment and marketing approaches were made by a higher proportion of cropping farms relative to livestock farms. The change of marketing approach may be partly because of more options being available for marketing grain in recent years.

Within the livestock industries, sheep farms generally made more changes across a range of innovative activities. This coincided with higher income increases in the sheep industry than in the beef or sheep-beef industries over the past two years. In particular, the sheep industry recorded the highest percentage of farms making changes to fertiliser practices (42 per cent) and introducing new crop types (34 per cent). These changes may also reflect an increase in the planting of fodder crops to finish lambs for sale during this period.

Beef farms were least likely to introduce new approaches to labour use, possibly because beef industry labour input is the lowest among broadacre livestock industries. A higher proportion of sheep-beef farms introduced innovative changes in labour use compared with other broadacre livestock industries. This may reflect the change in the sheep-beef industry in recent years. Many of these farms have effectively moved to the beef industry as they have been increasing beef cattle numbers steadily and have not rebuilt sheep numbers following recent droughts (Martin et al. 2009).

Innovative activities by state

New irrigation and water management practices were adopted by a significantly higher percentage of farms in Tasmania (41 per cent) and Victoria (39 per cent) (table 4). Reductions in the availability of irrigation water were particularly severe in the Victorian Murray-Darling Basin during 2006-07 and 2007-08. Changes in irrigation practices made by a high proportion of Tasmanian farms may be attributed to prolonged drought conditions, combined with the introduction of new irrigation areas in Tasmania over the period 2006-07 and 2007-08.

Around half of Western Australian broadacre farms introduced new cropping equipment over the period 2006-07 to 2007-08. This was consistent with the relatively high farm cash income and capital additions recorded by farms in Western Australia during this period (Martin et al. 2009).

In South Australia, a high proportion of farms introduced new approaches to marketing farm production (38 per cent). This coincided with an increased proportion of grain crops cut for hay in South Australia, high grain prices, particularly for domestic feed grains, and more options in the marketing alternatives for export grain.

In the Northern Territory, more than half the farms made changes to livestock handling practices in the two years ending 2007-08. Seasonal conditions in the southern and eastern

4 Farms making innovative changes by state, broadacre and dairy farms, 2006-07 and 2007-08

per cent of farms

Innovative activity	New South Wales	Victoria	Queensland	South Australia	Western Australia	Tasmania	Northern Territory
Marketing							
New approaches to marketing farm's production	27 (10)	22 (10)	25 (18)	38 (13)	27 (13)	24 (34)	17 (35)
Management/labour use							
New approaches to labour use	25 (11)	18 (15)	19 (12)	22 (15)	21 (15)	17 (23)	34 (20)
New members to farm's management	7 (15)	6 (21)	10 (23)	15 (21)	16 (19)	16 (47)	21 (31)
Natural resource management practices							
Weed-related natural resource management	20 (13)	27 (13)	35 (12)	17 (21)	13 (20)	34 (33)	26 (20)
Pest-related natural resource management	13 (13)	18 (18)	24 (12)	16 (19)	13 (19)	18 (35)	22 (22)
Soil-related natural resource management	24 (11)	25 (14)	24 (12)	24 (16)	30 (12)	16 (32)	17 (27)
Product changes							
New crop types	25 (14)	32 (10)	20 (22)	23 (16)	24 (16)	17 (28)	na
New crop cultivars	30 (12)	24 (12)	20 (22)	38 (12)	34 (13)	17 (21)	na
New livestock types	10 (16)	7 (22)	14 (27)	11 (21)	7 (32)	7 (40)	1 (74)
New livestock breeds	17 (13)	11 (18)	33 (17)	22 (24)	21 (19)	20 (30)	10 (41)
Production practice changes							
Fertiliser practices	37 (10)	37 (10)	35 (19)	35 (15)	24 (14)	23 (47)	na
Soil management practices	36 (10)	31 (12)	36 (25)	27 (13)	22 (17)	15 (36)	na
Weed, pest and disease management practices	26 (10)	25 (14)	35 (24)	31 (17)	21 (16)	18 (30)	na
Grazing management practices	22 (12)	17 (17)	23 (16)	17 (19)	14 (19)	19 (41)	28 (16)
Livestock feeding practices	22 (12)	23 (13)	19 (14)	17 (16)	16 (17)	23 (33)	21 (20)
Fodder conservation and use practices	12 (14)	21 (12)	11 (21)	9 (22)	10 (25)	12 (24)	1 (111)
Livestock handling practices	12 (15)	15 (16)	18 (21)	12 (23)	10 (23)	6 (33)	52 (15)
Livestock health practices	19 (12)	14 (18)	14 (21)	15 (25)	18 (18)	21 (26)	16 (27)
Pasture types	19 (13)	24 (12)	25 (19)	20 (18)	18 (16)	26 (21)	3 (89)

continued...

4 Farms making innovative changes by state, broadacre and dairy farms per cent of farms continued

	New South Wales		Victoria	Queensland	South Australia	Western Australia	Tasmania	Northern Territory						
Innovative activity														
Cropping equipment														
Equipment for cultivation, planting, fertilising, spraying and harvesting	38	(9)	34	(10)	36	(18)	35	(10)	50	(10)	20	(31)	na	na
Irrigation practices														
Irrigation and water management practices	27	(18)	39	(19)	24	(23)	7	(37)	3	(60)	41	(18)	29	(165)

na Not available.

Note: Figures in parentheses are standard errors expressed as a percentage of the estimate provided.

part of the territory were particularly dry in 2007-08, leading to a high level of destocking on cattle stations in this area. This may have resulted in more change to livestock handling practices. In addition, farm cash incomes in the Northern Territory were generally high over the period 2006-07 to 2007-08, which provided financial capacity in adopting new livestock handling practices.

Innovative activities by level of education

To assess the relationship between the adoption of innovation and farmer education, farms were split into two groups based on the highest level of education of the owner manager: secondary school or below and post secondary school.

Survey results (table 5) indicate that generally a higher proportion of farm owner managers educated at post secondary school level made innovative change than those farmers with secondary education or below. This result was consistent with general research on the effect of education and training on farm management practices (Kilpatrick 2000). Education and training had an effect on the farm business through: managers' awareness of a greater number of possible innovations; improved decision-making and allocation of resources; and attitudes which encourage changes.

Higher educated owner managers were more likely to purchase new cropping equipment (43 per cent), introduce new crop cultivars (35 per cent) and introduce new approaches to marketing the farm's production (35 per cent).

Farm characteristics by innovative change

Marketing

- There was a much higher proportion of broadacre farms (29 per cent) introducing new approaches to marketing farm production than dairy farms (9 per cent).
- A higher proportion of farmers (35 per cent) with post secondary educational level changed their marketing approaches, compared with farmers with secondary school education or below (23 per cent).
- A higher proportion of large family farms (39 per cent) introduced new marketing approaches compared with small family farms (21 per cent).
- Nearly 40 per cent of farms in South Australia reported the adoption of new marketing approaches, which was the highest proportion across states.

Management and labour use

- Introducing new members to the farm's management team was the innovative activity least adopted by broadacre farms (9 per cent) in the two years ending 2007-08. The adoption of this change was also low for dairy farms (10 per cent).
- A higher proportion of dairy farms (27 per cent) introduced new approaches to labour use than broadacre farms (20 per cent).

5 Innovative change by level of farmer education, broadacre and dairy farms, 2006-07 and 2007-08 per cent of farms

Innovative activity		secondary school or below		post secondary school	
Marketing					
New approaches to marketing farm's production	%	23	(6)	35	(9)
Management/labour use					
New approaches to labour use	%	20	(7)	23	(10)
New members to farm's management	%	9	(10)	9	(16)
Natural resource management practices					
Weed-related natural resource management	%	23	(7)	26	(12)
Pest-related natural resource management	%	15	(9)	19	(15)
Soil-related natural resource management	%	22	(7)	30	(10)
Product changes					
New crop types	%	25	(8)	28	(10)
New crop cultivars	%	26	(8)	35	(9)
New livestock types	%	9	(11)	11	(18)
New livestock breeds	%	16	(9)	24	(12)
Production practice changes					
Fertiliser practices	%	34	(6)	35	(9)
Soil management practices	%	30	(8)	35	(9)
Weed, pest and disease management practices	%	26	(8)	29	(10)
Grazing management practices	%	16	(9)	26	(13)
Livestock feeding practices	%	19	(8)	24	(10)
Fodder conservation and use practices	%	14	(9)	14	(15)
Livestock handling practices	%	13	(11)	15	(12)
Livestock health practices	%	15	(10)	19	(14)
Pasture types	%	21	(8)	22	(12)
Cropping equipment					
Equipment for cultivation, planting, fertilising, spraying and harvesting	%	36	(6)	43	(8)
Irrigation practices					
Irrigation and water management practices	%	26	(15)	33	(15)

Note: Figures in parentheses are standard errors expressed as a percentage of the estimate provided.

- Farms in the beef industry reported the lowest proportion of farms introducing new members to the management team (5 per cent) and introducing new approaches to labour use (14 per cent).

Natural resource management practices

- On average, nearly one-quarter of broadacre farms introduced new actions to address weed-related or soil-related problems, while 16 per cent of broadacre farms introduced new actions to address pest-related problems.
- On average, nearly one-third of dairy farms introduced new actions to address weed-related problems, and an estimated 23 per cent of dairy farms introduced new actions to address pest-related or soil-related problems.
- A higher proportion of large family farms introduced new natural resource management practices compared with small family farms.

Product change

- Introducing new crop cultivars was the most common product change among broadacre farms (31 per cent) over the two years ending 2007-08.
- Introducing new crop types was the most common product change among dairy farms (32 per cent) over the two years ending 2007-08.
- A higher proportion of farmers with post secondary education introduced new crop cultivars (35 per cent) or new livestock breeds (24 per cent) compared with farmers with secondary school education or below.
- A higher proportion of large family farms introduced new crop types (29 per cent) or cultivars (37 per cent) than small family farms.

Production practice change

- The most common production practice change for broadacre farms was to adopt new fertiliser practices (35 per cent).
- Introducing new soil management practices ranked highly for broadacre farms (31 per cent).
- A higher proportion of dairy farms adopted changes to pasture types (35 per cent) as well as fodder conservation and use practices (35 per cent) compared with broadacre farms.
- The adoption of new livestock handling practices was recorded by more than half of the farms in the Northern Territory. This was the most common innovative change reported by farms in the Northern Territory, while in other states the proportion of farms adopting new livestock handling practices was relatively low.
- Farms in the beef industry were least likely to adopt changes to fodder conservation and use practices (7 per cent) compared with other broadacre farms.

Cropping equipment

- Nearly 40 per cent of broadacre farms introduced new cultivation, crop planting, fertilising, spraying and harvesting equipment over the two years ending 2007-08.
- A higher proportion of farmers (43 per cent) with post secondary education purchased new crop production equipment than farmers with secondary education or below (36 per cent).

- Around half of Western Australian farms reported the introduction of new cropping equipment. This was the most reported innovative change in Western Australia.
- More than half of large family farms invested in new cropping equipment, which was significantly higher than for small family farms (29 per cent).
- Within broadacre industries, farms in the wheat and other crops industry recorded the highest proportion of farm businesses introducing new cropping equipment (47 per cent).

Irrigation practices

- Introducing new irrigation and water management practices was the most popular innovation adopted by dairy farms (42 per cent) and by farms in Tasmania (41 per cent).
- Cropping farms were more likely to report innovative changes in irrigation and water management practices than livestock farms.
- There was a significant difference in the adoption of irrigation and water management practices between large family farms (45 per cent) and small family farms (17 per cent).

3 Farm financial performance and innovation decision

A number of researchers who have looked at the adoption of innovations by farmers have indicated that farm financial characteristics are likely to have an influence on farmers' decisions to adopt innovative ideas (Fenton et al. 2000). By linking responses for the farm innovation survey to farm financial performance data, a comparison of financial performance can be made between farms making innovative changes and those not.

Two measures of farm financial performance were chosen to undertake this comparison. The first is farm cash income, defined as total cash receipts less total cash costs. This is a simple measure of net cash flow generated by a farm business. Farms with higher farm cash incomes are generally expected to have more cash flow available for investment in innovative changes.

The second measure is rate of return excluding capital appreciation, which is a more complete measure of farm economic performance. Rate of return is calculated by expressing the farm's business profit adjusted to a full equity basis (as if the farm business was fully owned) as a percentage of the total capital value of the farm business. The calculation of farm business profit adjusts farm cash income for the value of depreciation, value of unpaid labour (family labour used) and changes in the inventory of trading stocks (e.g. grain and livestock on hand). Adjusted profit as a percentage of the total capital used by the farm also leads to a measure of farm performance that is not as strongly correlated with farm business size as is farm cash income. Therefore, rate of return is a good measure for comparing farm performance across a range of farm businesses sizes.

Innovative change for top and bottom performing farms

First, a comparison is made of the adoption of innovative changes between the top and bottom performing farms ranked by rate of return. Farms were ranked by rate of return to capital excluding capital appreciation and grouped into quartiles based on a three year moving average of their individual rate of return.

Survey results indicate that, in general, a higher proportion of farms which ranked in the top 25 per cent of farms by rate of return adopted innovative changes for the period 2006-07 to 2007-08 than farms ranked in the bottom 25 per cent (table 6).

A much higher proportion of top performing farms implemented new approaches to marketing their farm's production, changed labour use and introduced new members to the farm's management team than the bottom 25 per cent of farms. The proportion of top performing farms was also higher than bottom performing farms that introduced new equipment for cultivation, planting, fertilising, spraying and harvesting, and that introduced irrigation and water management practices in the two years ending 2007-08.

6 Farms making innovative changes ranked by rate of return, broadacre and dairy farms, 2006-07 and 2007-08 per cent of farms

Innovative activity		bottom		top		all farms	
		25 per cent a		25 per cent a			
Marketing							
New approaches to marketing farm's production	%	18	(16)	40	(5)	26	(5)
Management/labour use							
New approaches to labour use	%	17	(23)	26	(7)	21	(6)
New members to farm's management	%	5	(25)	13	(14)	9	(8)
Natural resource management practices							
Weed-related natural resource management	%	26	(16)	29	(8)	24	(6)
Pest-related natural resource management	%	16	(18)	17	(11)	16	(7)
Soil-related natural resource management	%	25	(15)	31	(7)	25	(6)
Product changes							
New crop types	%	27	(17)	28	(8)	26	(6)
New crop cultivars	%	30	(16)	37	(7)	28	(6)
New livestock types	%	8	(24)	9	(17)	9	(10)
New livestock breeds	%	15	(16)	20	(10)	19	(8)
Production practice changes							
Fertiliser practices	%	37	(15)	36	(7)	34	(6)
Soil management practices	%	34	(16)	33	(8)	31	(6)
Weed, pest and disease management practices	%	28	(15)	34	(8)	27	(6)
Livestock feeding practices	%	21	(19)	23	(8)	20	(7)
Fodder conservation and use practices	%	12	(27)	18	(11)	14	(8)
Livestock handling practices	%	14	(22)	16	(11)	14	(8)
Livestock health practices	%	14	(20)	20	(9)	16	(8)
Grazing management practices	%	19	(19)	22	(9)	19	(7)
Pasture types	%	21	(14)	22	(9)	22	(7)
Cropping equipment							
Equipment for cultivation, planting, fertilising, spraying and harvesting	%	32	(16)	48	(6)	38	(5)
Irrigation practices							
Irrigation and water management practices	%	19	(15)	35	(20)	28	(9)

a Farms ranked by rate of return excluding capital appreciation.

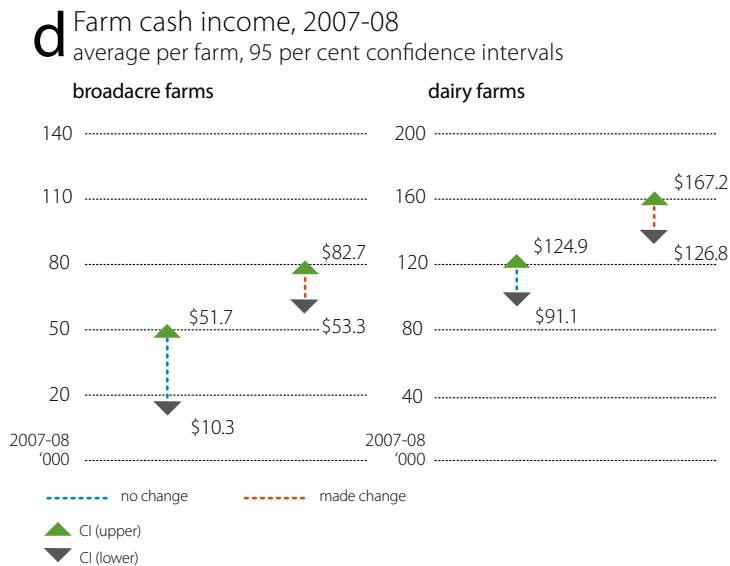
Note: Figures in parentheses are standard errors expressed as a percentage of the estimate provided.

Farm financial performance and decision to adopt innovation

In the following section, the financial performance of adopting and non-adopting farms in the 2007-08 year is compared. The aim was to highlight any association between the financial performance of farms in 2007-08 and the decision to adopt innovations over the period 2006-07 to 2007-08.

Effect of broadacre and dairy farm financial performance on innovation decision

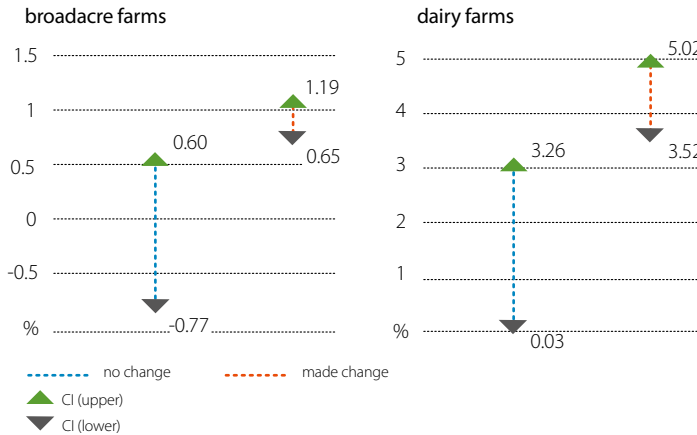
In 2007-08, the average farm cash income of broadacre farms that made innovative changes was significantly higher (at the 95 per cent confidence level) than that of farms making no changes (figure d). That is, there is a 95 per cent probability that average farm cash income of broadacre farms that made innovative changes is between \$53 300 and \$82 700 and a 95 per cent probability that farm cash income is between \$10 300 and \$51 700 for broadacre farms that made no innovative changes. The average farm cash income of dairy farms that made innovative changes was also significantly higher than that of farms making no changes (figure d).



Similarly, the average rate of return for both broadacre and dairy farms making some innovative changes was significantly higher (at the 95 per cent confidence level) than the rate of return for farms not making innovative changes (figure e).

These results suggest that overall adoption of innovation is generally associated with the level of cash flow generated by the business and the underlying profitability of the farm businesses.

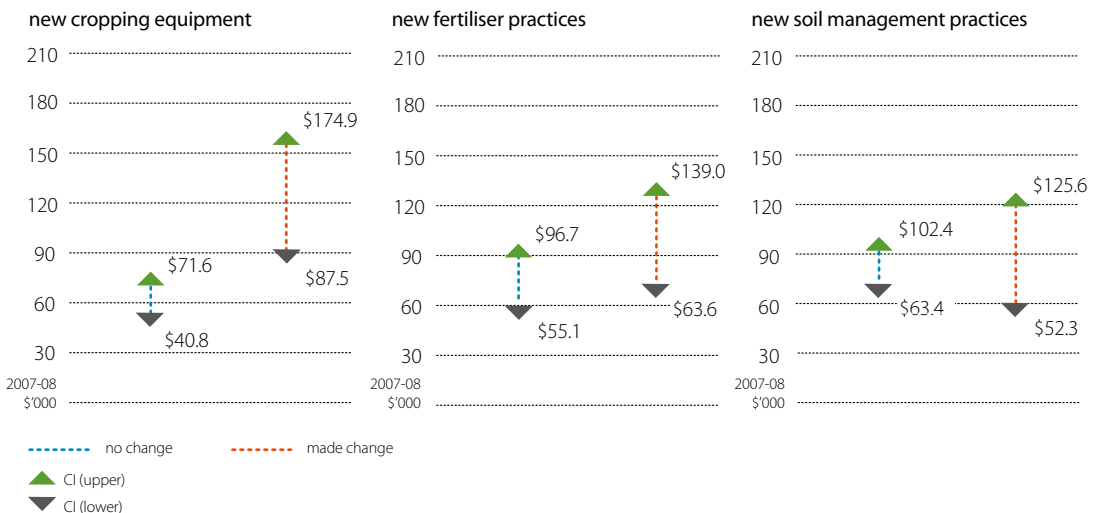
e Rate of return, 2007-08
average per farm, 95 per cent confidence intervals



Effect of farm financial performance on adopting common broadacre innovations

Average farm cash income of broadacre farms adopting new cropping equipment, new fertiliser practices and new soil management practices in the two years ending 2007-08 was compared at the 95 per cent confidence level with that of broadacre farms that did not adopt these changes (figure f).

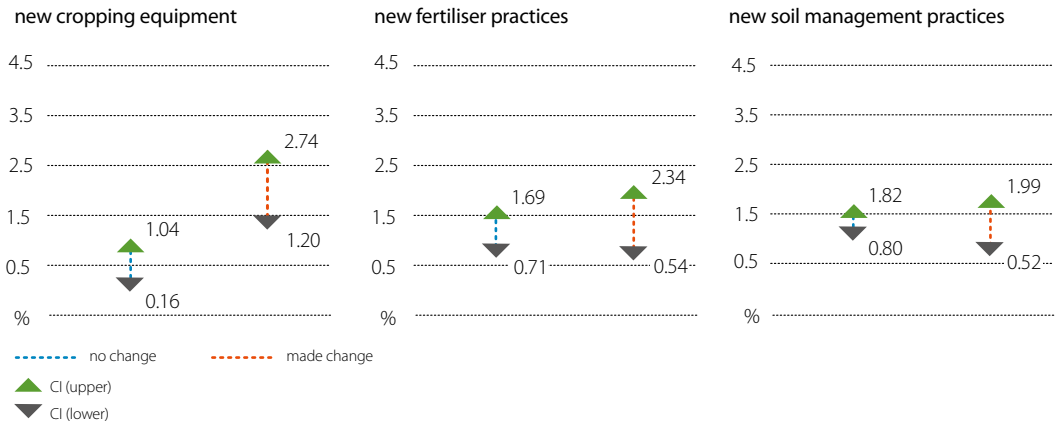
f Farm cash income: broadacre industry, 2007-08
average per farm, 95 per cent confidence interval



Average farm cash income for broadacre farms adopting new cropping equipment was significantly higher than for those not making changes. However, there was no evidence this was also the case for broadacre farms that introduced new fertiliser practices or soil management practices.

Similar results were found comparing the 95 per cent confidence interval for average rate of return for broadacre farms that made innovative changes with that for farms not adopting new cropping equipment, new fertiliser practices and new soil management practices (figure g).

g Rate of return: broadacre industry, 2007-08
average per farm, 95 per cent confidence intervals

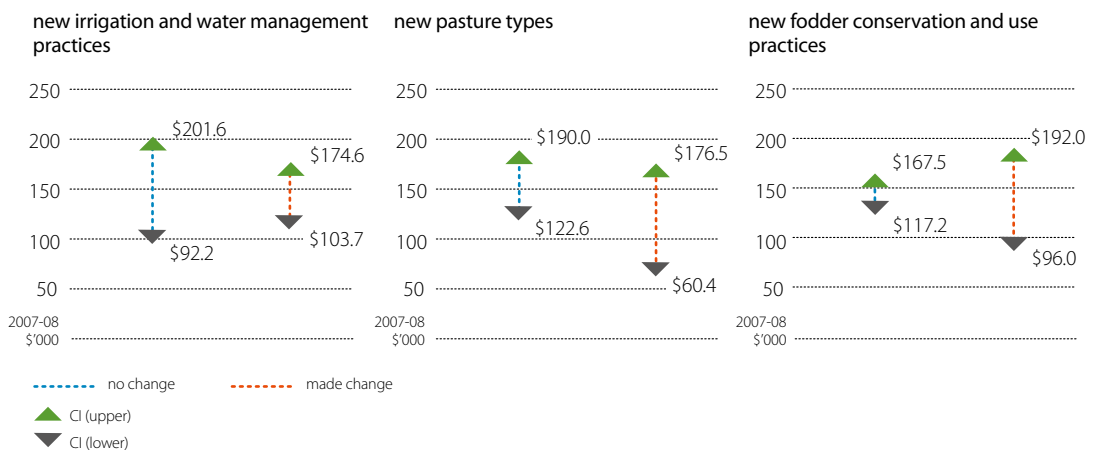


These results suggest farmers' decisions to adopt more capital-intensive innovations, such as the purchase of new equipment, are likely to be associated with farm financial performance. However, in relation to other types of innovation, other factors may be more influential on farmers' adoption decisions.

Effect of farm financial performance on adopting common dairy innovations

Average farm cash income of dairy farms adopting new irrigation and water management practices, new pasture types, and new fodder conservation and use practices in the two years ending 2007-08 was compared at the 95 per cent confidence level with that of dairy farms not adopting these changes (figure h).

h Farm cash income: dairy industry, 2007-08
average per farm, 95 per cent confidence intervals

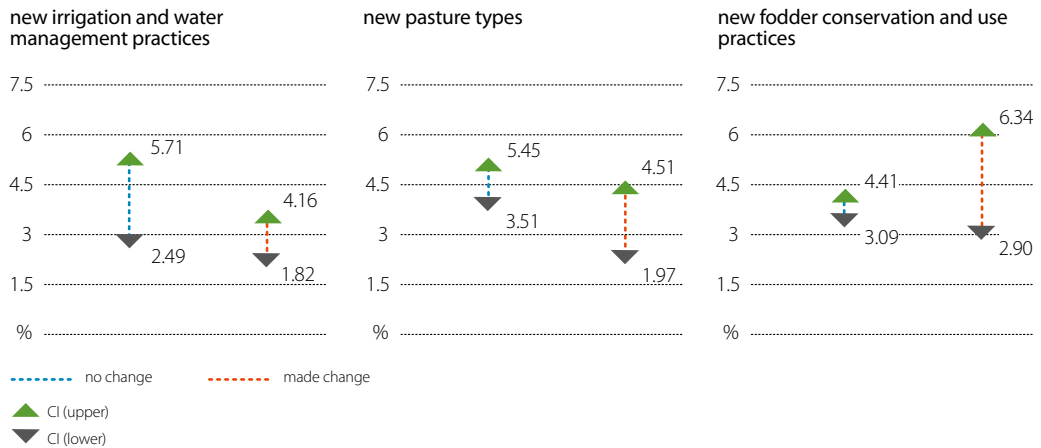


There was no evidence average farm cash income of dairy farms adopting these common dairy innovations was significantly different from that of dairy farms not adopting these changes.

Similar results were found comparing the 95 per cent confidence interval for average rate of return for dairy farms making changes, with that for farms not making changes on irrigation practices, pasture types or fodder use practices (figure i).

These results indicate that the decision to adopt new irrigation and water management practices, new pasture types, and new fodder conservation and use practices by dairy farms may be more influenced by other factors than the level of cash flow or farm profitability.

i Rate of return: dairy industry, 2007-08
average per farm, 95 per cent confidence intervals



4 Conclusions

These preliminary results from the farm innovation survey are generally consistent with the findings from Australian and international research on farm innovation adoption (Fenton et al. 2000; Diederer et al. 2003). The adoption of innovation is broadly associated with structural characteristics of farm businesses such as business size, farmers' education, farm sector, location of the farm, as well as farm financial characteristics such as the level of farm cash income or the underlying long-term profitability of the farm business. However, the adoption of a range of innovations, in particular less capital-intensive and more management-intensive innovations, are likely to be driven by a wide range of factors including behavioural factors.

In broad terms, innovative changes made by broadacre and dairy farms over the two years ending 2007-08 appear to have been mainly motivated by either an improved capability to implement change as a consequence of increased income or reduced costs of implementation, or an imperative to act because of circumstances imposed by factors including seasonal conditions and high farm input prices. In particular, reductions in the cost of adopting changes and increases in farm cash income during this period provided farmers with a strong incentive to adopt capital-intensive innovations such as investment in new cropping equipment. On the other hand, innovative changes may have been imposed on farmers by low availability of irrigation water and increases in fertiliser prices.

To facilitate the best longer term outcomes for farm profitability and productivity, these outcomes imply that farmers require well formed business and investment plans to ensure they make appropriate decisions in times of opportunity and are well informed on management and technology options in times of challenge.

Further economic analysis of the 2007-08 farm innovation data will be undertaken to identify key determinants of farm innovative behaviour and the relationship between innovation adoption and productivity growth among broadacre and dairy farms. In addition, ABARE intends to continue collecting similar data to monitor the effect of farmers' adoption of innovation on longer term farm productivity and farm performance.

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