

Funded and supported by:



Research
*Australian Centre for Sustainable
Business and Development*

**GARDINER
FOUNDATION**



Feedbase management: A survey of Victorian Dairy farmers

Geoff Cockfield

Natalie Doran-Browne

ACKNOWLEDGEMENTS

The authors would like to thank the Gardiner Dairy Foundation Board and staff for funding and supporting this project.

The project was also supported by Dairy Australia, especially through the extensive logistical and administrative work of the Regional Development Programs, GippsDairy, Murray Dairy and WestVic Dairy.

We especially thank the 170 interviewees, more than 150 of whom were dairy farmers, as well as the service providers and members of the five discussion groups who donated considerable time and information to the project. In addition, the interviewees generously welcomed the researchers into their homes and meetings.

Table of Contents

Acknowledgements	i
Table of Contents	
Executive summary	1
recommendations	3
1. Overview of the study	5
PROJECT OVERVIEW	5
Background	5
Methods	5
conceptual influences	5
Recruitment and interview sample	6
survey timing and context	7
Climatic trends	7
Analysing attitudes to change	8
Recommendations	8
2. Feedbase performance	10
3. Feedbase Systems	12
grass Pastures	12
alternative pastures and crops	12
buying in feed	13
fertilisers and soil management	13
irrigation management	14
4. Drivers of change in feedbase management	15
Overview	15
Seasonal conditions and climatic trends	15
Financial position and market signals	15
Positive perceptions of the future of the industry	16
Business growth phases	16
Generational change	16
Innovations of other farmers	16
Education, training and exposure to other production systems	17
Benchmarking	17
Recommendations	18
5. Barriers to practice change	19
Recommendations	23
6. development programs	25
perspectives on industry programs	25
7. Communication, engagement and extension	28
Targeting extension	28
Farmers, heuristics and decision-making	28

The relationships with service providers.....	30
communication preferences	31
8. Perspectives on personal learning priorities and industry research	32
9. Summary and conclusions	34
Appendices	36
Appendix 1: Survey questions (producers).....	36
Appendix 2: Survey questions (advisors)	41
Appendix 3: Perspectives on decision-making.....	43
Appendix 4: Attitudes to the future of the industry	46
Appendix 5: Climate trends in the study regions	47
Appendix 6: DAFS industry segments and implications for influence.....	56
Appendix 7: New entrants to the dairy industry	57
Appendix 8: Career transitions and succession	58
Appendix 9: Farmer personal learning and industry research priorities	59
References.....	61

Table of Figures

Figure 1: Location of interviews	9
Figure 2: Annual average rainfall for Gippsland, Western and Murray dairy regions of Victoria, averaged from ~50 farms in each region from 1900 to 2016.....	47
Figure 3: Variations in long-term annual average rainfall for dairy farms in each of the Gippsland (52 farms), Western (51 farms) and Murray (50 farms) dairy regions of Victoria.	48
Figure 4: Variations in long-term average monthly rainfall for 52 farms in the Gippsland dairy region of Victoria	49
Figure 5: Variations in long-term average monthly rainfall for 51 farms in the Western dairy region of Victoria	50
Figure 6: Variations in long-term average monthly rainfall for 42 farms in the Murray dairy region of Victoria (excluding north east Victoria).....	51
Figure 7: Variations in long-term average monthly rainfall for 7 farms in north east Victoria in the Murray dairy region.....	52
Figure 10: Variations in the Temperature Humidity Index (THI) for dairy farms in each of the Gippsland (52 farms), Western Victoria (51 farms) and Murray (50 farms) dairy regions of Victoria.	55

Table of Tables

Table 1: Number of interviews in each Victorian dairy region.....	8
Table 2: Characteristics of sample farms	9
Table 3: Home-grown feed consumption rates from existing studies.....	11
Table 4: Rates of home-grown feed consumed and conserved from the Dairy Farm Monitor Project (DEDJTR 2015; 2016).....	11
Table 5: Selected cognitive tendencies and their effects	44
Table 6: Variations in monthly rainfall patterns when comparing 1990-2016 to 1900-2016 long term average rainfall	53
Table 7: Average number of days per year within a specified temperature range.....	54

EXECUTIVE SUMMARY

The objectives of this project were to engage with and understand the range of feed systems and practices used on dairy farms in the three dairy regions of Victoria; and to examine the potential to increase home-grown feed (HGF) production and utilisation in those regions. The study included investigation of business management practices, learning preferences, information needs and views on industry direction and research. The study design was informed by different perspectives on farm management, conventional economic theories of production decisions, and ideas from behavioural economics and cognitive sciences. The work was primarily to inform research prioritisation decisions, research translation, extension and engagement with producers.

We interviewed people representing 153 farm businesses and 19 farm business advisory roles, and conducted focussed discussions with five producer groups. From those, we recorded, transcribed and analysed data for this report. We have produced a number of recommendations and some suggestions for further investigation.

We find there is strong evidence from previous studies and the informed opinions of project advisors, farm business advisors we interviewed and Regional Development Program extension staff, that there is potential to considerably increase HGF production and utilisation. Many farmers acknowledge the potential to increase production on their own farms but are cautious about making changes to current production systems.

We identified a number of reasons why farmers don't or are reluctant to, make changes to feedbase (and other) management practices, including:

- Cash flow and financial considerations;
- Concerns about seasonal and market conditions;
- Time availability;
- Labour availability and quality;
- Policy uncertainty;
- Farm layout and infrastructure;
- High self-reliance (on own, family or peer information and ideas);
- Social and learning preferences;
- Stage of life or achievement (winding down or contentment with current state);
- Being in a non-growth business stage of the farm business;
- Succession issues; and
- Risk averseness.

The three dominant impediments to change appeared to be: 1) cash flow and financial considerations, 2) available time to implement change and manage a different system and 3) limitations on labour availability.

We also identified a number of factors that have encouraged, or are likely to encourage, people to make changes to feed systems, and other elements of the business. These are:

- Seasonal conditions and climatic trends;
- Financial position and market signals (milk prices, water prices, debt levels and cash flow);
- Positive perceptions of the future of the industry;
- Being in, or considering a period of business growth;
- Generational change;
- The innovations of other farmers;
- Education, training and exposure to other systems; and
- 'Benchmarking' (broadly defined).

Given that many people will be in a non-growth phase, have a high degree of self-reliance and/or be experiencing particular constraining circumstances at any one time, we recommend a tiered approach to engagement to promote recommended HGF and other practices. At a base level, the RDPs have the capacity to identify, understand and 'stay in touch' with farm businesses. This would be a low-key engagement and focus on building and maintaining relationships.

On top of that, there could be a coordinated approach to promoting and working through those extension pathways that are both popular and effective.

These pathways include:

- Discussion groups run by RDPs, private consultants or farmers themselves;
- Business and practice networks;
- Focus farms;
- Industry programs, including those for feedbase, business management and labour management;
- Benchmarking systems (eg DairyBase);
- Highlighting individual farmer innovations through field days and case studies; and
- Exposing producers to innovations and ideas from other dairying areas (and countries) and even other agricultural industries.

Current research, expertise, advice and training programs is sufficient to support practice change that could lead to increased HGF production. Indeed, the calendar of learning opportunities appears to be very crowded. On that, we recommend increasing efforts to coordinate extension programs by priority topics and working with private providers to reduce industry training repetition and redundancy. The engagement and delivery loads could also be reduced through greater targeting – the right development program for the right people at the right time.

Farmers generally support research on improving pasture varieties, crop selection and other production issues, though many farmers and even some service

Feedbase management

providers know little about specific and even major developments. We therefore make recommendations in the report on the key requirements for improving the communication of available and future research to farmers.

Many farmers and some advisors see value in industry programs such as *Feeding Pastures for Profit*, though there are issues of the level at which such programs are pitched and the perceptions of where farmers see themselves sitting in terms of pasture management skills. With increasing diversity in feed sources and strategies, especially in the more climatically marginal and irrigation areas, there will be demand for programs that include crops and alternatives to annual and perennial ryegrass.

We see that farm operators are more able to dedicate time and effort to better feedbase management when they have labour management skills and their employees have appropriate technical skills. The dairy farming environment is cognitively and physically intense and a more skilled management and labour force will help spread the physical and cognitive loads. Priorities for this include programs that build:

- leadership and people management skills;
- problem solving, decision-making and planning skills; and
- the industry skill base and promote career pathways.

The second area that will support better feedbase decision-making is developing business management skills. This is widely recognised amongst farmers as a critical area, yet it can easily be allocated a much lower priority amongst the day-to-day tasks and activities. Establishing the principles of business management, financial management, people management, decision-making and planning will

enable better implementation of feedbase fundamentals and innovations into the farm business.

If there is a connecting thread in relation to extension, it is **the need to engage farmers in conversations, with experts, consultants or other farmers that encourage reflection on assumptions and practices**. Dairy farmers, as with all people, use intuitive thinking and rules of thumb to make decisions within a complex and dynamic environment. This is natural, efficient and necessary, but at the same time these approaches to management decisions have some risks in that it is easy to miss or ignore relevant and useful information and ideas.

There are however a number of ways of engaging with farmers, and the effects will be much greater where account is taken of personality, business and career stage, seasonal and market conditions and the structure and goals of the farm business.

Farmers would generally benefit from regular external advice, however there would need to be great care around any strategy involving advocacy for seeking external advice, given the commercial and competitive nature of advisory services.

Finally, presenting research and extension in ways that are relevant to farmer priorities and concerns will help farmers reflect on their practices, particularly if the new information can be integrated into routine work. To some extent, farmers and researchers operate in different cognitive contexts. The strategies to promote reflection help to move farmers towards the researchers' way of thinking but there would also be benefits from greater efforts to translate research in ways that are more accessible to farmers.



RECOMMENDATIONS

Recommendation 1:

That dairy extension workers and industry bodies be encouraged to draw on a select few segmentation frameworks which are agreed amongst key industry organisations and applied according to the particular issue or goal, rather than universally.

Recommendation 2:

Industry bodies should continue to promote and where appropriate provide, opportunities for farmers to increase business and management skills. This can include through education, training and learning about other dairy and agricultural and business systems.

For example, tours, scholarships and training opportunities could have clear connections to goals such as increasing profitability through feedbase management.

Recommendation 3:

Industry extension programs be prioritised by seasonal and market conditions.

This already happens to some extent, with programs such as *Tactics for Tight Times* and *Taking Stock*.

There is however a case for including seasonal and market factors in an overall annual planning process. Such a framework could be developed in consultation with an industry group.

Recommendation 4:

Identify ways in which aspects of feedbase performance (and other) program elements could be, or continue to be, delivered through discussion groups.

These program elements might best be tasters or introductions, rather than full programs, as it would be important not to overload discussion groups.

Recommendation 5:

RDPs could identify situations where additional discussion groups might be set up to fill gaps and increase participation.

This might include creating groups for more reserved personalities, businesses at particular stages or creating or reviving particular types of engagements. There are different historical engagement models in regions and sub-regions that should be considered in developing these. RDPs are already working in such ways.

Recommendation 6:

Researchers and extension personnel continue to promote good practice, as demonstrated by well-regarded farmers, but ensuring these practices align with research findings.

This approach could be developed from *ad hoc* promotion to be part of an annual strategic planning cycle. This focus on farmers could include case study vignettes for brochures or webcast material.

Recommendation 7:

Industry organisations could consider formal mentoring programs, which could include coordinating mentor/mentee engagements and training and support for potential mentors.

In addition to a one-on-one mentor program there could also be an 'inventory' of farmers with specific skill sets who are willing to help other farmers and who could be contacted on an as-needs basis for peer support and information.

Recommendation 8:

Promote, or continue to promote and where appropriate, provide programs in, business management and leadership skills.

An understanding of business principles, decision-making and leadership are critical to feedbase management decisions. Such programs were identified as important by many of our survey respondents (see Appendix 9 on survey responses on research and learning needs).

Recommendation 9:

Continue and if needed, develop labour programs to build industry skills.

More and higher skilled labour availability will allow for greater specialisation of task management within the farm, which will in turn allow for greater attention to things such as feed production, grazing management and nutrition.

We are aware of the difficulties of attracting people into the industry and regional areas more generally, but labour quality and availability is an important area. In conjunction with labour availability, it is important for farmers to develop employee management skills in farmers to help manage and retain employees.

Recommendation 10:

Examine structures for, and attitudes to, labour hire businesses that could supply casual but well-trained labour.

Given the difficulties of attracting permanent workers and the cost of such workers, there could be many benefits in being able to draw on pools of skilled labour. This could provide additional labour at peak times or allow people from the business to attend training opportunities.

This recommendation should however be considered carefully, given the problems with, and adverse publicity about, labour hire schemes in other industries such as horticulture. Note though, that this recommendation extends beyond just international labour hire.

Recommendation 11:

Examine if and how discussion groups might be supported to increase participation.

Feedbase management

This would require greater understanding of the dynamics of discussion groups, especially those targeting people who may not normally participate in other groups, considering:

- What makes them work?
- Who comes to what type of group?
- What are the barriers to participation?

We recommend further developing a system where farmers invite other farmers to discussion groups, targeted towards people who have not previously participated in such groups. This already happens informally.

Recommendation 12:

Where farmers have a preference for the current operation and/or a high degree of self-reliance, then RDPs and other extension providers should adopt a 'keep in touch' approach.

This would involve regular and low-key contact, occasional highly targeted information on matters of interest and checking on any changes of circumstance.

Recommendation 13:

Research presentations and training programs should routinely include, in addition to financial analyses, discussion of the potential impact of changes on:

- skill requirements;
- paddock availability;
- time requirements for the main business operator/s, both in the short and medium terms; and
- additional management requirements.

Recommendation 14:

Peer learning is a strong and enduring preference amongst farmers. Where possible, continue to provide peer interaction time as part of learning activities, especially involving paddock settings:

- Continuing to build paddock activities into industry programs;
- Working through, and if affordable expanding, the Focus Farms program;
- Working through existing discussion groups;
- Filling discussion group gaps with different types of groups appropriate to target groups, regions and sub-regions;
- Encouraging and facilitating mentoring; and
- Providing and highlighting case studies of successful practice change.

Recommendation 15:

Feedbase and other programs would benefit from industry-level coordination. The first form of coordination, in which key players including Gardiner Dairy Foundation could take a lead role, is identifying the practices that, based on sound research will yield the most benefits. These would then become priorities that are promoted through the program and extension infrastructure, such as discussion groups, Focus Farms and so on.

Recommendation 16:

The second coordination role, most probably resting with DA and the RDP, is in managing the now very crowded dairy 'calendar' and prioritising programs and program foci according to: Industry extension priorities as above;

- Seasonal and market conditions;
- New research findings;
- Likely profit impact; and
- Particular regional issues.

Recommendation 17:

Industry research bodies commissioning research (DA, Gardiner etc) could require more consideration of translation and implementation in their funded research. This would include:

- Building in rules of thumb for application;
- Integrating application into work day/week; and
- Outline impacts of proposed change on:
 - Cash flow;
 - Implementation period;
 - Production (short and long term);
 - Working week/day; and
 - Skill needs.

Recommendation 18:

There is a case for integrating exercises in self-reflection into feedbase and other management programs. There would be three parts to this.

First, showing that intuitive thinking is dominant, practical and generally effective but pointing out the limitations and risks.

The second aspect, would be encouraging people to review their decision-making patterns to build awareness of their tendencies and the influence of 'biases'.

Thirdly, would be some reflection on their own objectives and preferences, since the business and farm systems need to be reasonably compatible with what people are comfortable doing.

1. OVERVIEW OF THE STUDY

PROJECT OVERVIEW

This project originated from industry discussions of ways to boost the profitability of dairy farms through increasing the production and utilisation of home-grown feed (HGF). The Gardiner Dairy Foundation then convened an industry workshop that included consultation with researchers, farm advisors and producers, leading to the development of this project.

The aims of the project were to engage with and understand the range of feed systems and practices used on dairy farms and to examine the potential for increasing HGF feed production and utilisation. Production and management issues experienced by farmers were examined, as well as drivers and barriers to the adoption of improved feedbase performance. Finally, dairy farmers' information and learning needs and preferences were identified and considered in relation to existing research and extension services. A primary goal of the project was to inform investment in research and extension around the feedbase.

BACKGROUND

In Australia, managing feed on dairy farms is considered a key contributor to profitability (Fulkerson and Doyle 2001), with HGF seen as the cheapest source of feed on many pasture-based dairy farms (Savage and Lewis 2005). Economic modelling suggests that even modest increases in HGF can produce substantial increases in profit (see for example Chapman, Kenny, and Lane 2011).

Significant investment has been made in the research of HGF production and management, yet adoption of innovations in feedbase management has been patchy. There is both evidence and informed opinion that HGF production and utilisation could be increased. Programs such as *Target 10* and *Feeding Pastures for Profit*, aimed at developing the pasture management basics, have had a reasonable reach and are certainly credited by some of the respondents in these interviews, with contributing to changes in practices and production. A key objective of this project was to identify if and how contemporary industry programs and extension opportunities can be adapted or complemented to contribute to profitability.

The second aspect of extension services that we considered was the perceived obligation of industry to farmers and where industry funds should be allocated. There was a range of views on this, from the obligation to provide something to individual farm businesses, to those who believe the industry provides plenty of research and extension and it is up to farmers to take up what is on offer. We consider these different perspectives in our discussion and recommendations.

METHODS

The project concentrated on the three dairy regions of Victoria: Gippsland, the Murray region and Western Victoria. A total of 170 interviews were conducted with around 50 interviews in each region being with people representing farm businesses. The remaining interviews were with those in industry advisory roles (Table 1). Additionally, there were five focussed discussions with producer groups. The interviews were recorded, transcribed and the data then analysed.

The method of data collection was semi-structured interviews. There was a set of common questions for producers and another set for advisors (see Appendices 1 and 2), with the questions of three types:

- Questions on the scale and parameters of the farm business or advisor experience;
- Categorical questions about respondent backgrounds, farm management and advisory practices and so on and these responses could be coded *post hoc*; and
- Open questions to learn about the respondent and the business and to identify additional areas of interest.

For data analysis, scale responses were, where necessary, converted to common units (acres to hectares; litres/head to Kg MS/head), while categorical responses were manually reviewed and categories iteratively identified. Some parts of the responses to the open questions could be added to scale and category information, while other elements contributed to understanding context, issues and practices outside those we expected to hear about. These data were then entered into Excel spreadsheets to allow summaries, some of which are presented in this report.

CONCEPTUAL INFLUENCES

In addition to the industry interviews as described above, the survey was informed by two bodies of literature. First, the extensive farm management literature around adoption and non-adoption of technology was considered, as well as literature on research-based practices and the economics of such practices. Secondly, we incorporated some insights from the emerging behavioural economics literature, itself derived from work in cognitive psychology.

In particular, the questions and discussions were influenced by the proposition that fast, intuitive decision-making, employing multiple heuristics (rules of thumb or guiding assumptions) is the dominant way in which decisions are made. We argue below that this is what would be expected with the complexity of dairy systems and the demands on key decision-makers. This is widely understood by experienced extension workers and consultants but much of the

Feedbase management

research and extension material is based on more conventionally rational models of decision-making.

To illustrate this, research findings and decision-support systems are often framed on the implicit assumptions that farmers are willing and able to evaluate evidence, update their thinking, assess and respond to risk and probabilities, evaluate the economics of investment and practice options, and modify the existing farm system to incorporate these new processes and ways of thinking. This is more fully discussed in Appendix 3, where we argue that there are good reasons for doubting the capacity of individuals to be consistently, or even predominantly, objective and reflective.

RECRUITMENT AND INTERVIEW SAMPLE

Dairy farmers were recruited for interviews through the three Victorian Regional Development Programs (RDPs): GippsDairy, Murray Dairy and WestVic Dairy, with the aim of achieving a sample that included ranges of:

- Age, particularly ensuring representation of those likely to be in the industry for the next 10-20 years;
- Farm scales (by cow numbers);
- Farm systems (for example, including robotic dairies, large covered areas, mixed farms and so on);
- Locations within each region;
- Backgrounds, to include those on multi-generational farms, as well as first generation farmers and recent entrants to the industry. Some early career dairy farmers (in the industry for less than five years) were present in the sample for each region, as well as some corporate farms;
- Business priorities; and
- Engagement with RDPs and industry organisations and programs more generally.

The final sample was not formally stratified for a number of reasons. Firstly, there is insufficient information about the total populations of dairy farmers in each region. Secondly, in relying on volunteer participants, some skewing is almost inevitable, and finally, we had an ambitious target of 50 farms per region, which meant we needed to have some latitude in recruiting by type.

Because of the recruitment pathways, the sample may have been skewed towards industry-engaged farmers, though considerable efforts were made by the RDP staff to recruit people who had relatively little industry engagement. Recruitment strategies varied slightly between regions and this may mean some variations in sample types.

Nonetheless we believe the samples covered a range of farm business types and scales (see Table 2), reasonable geographical distribution (see Figure 1),

and varying levels of industry engagement from those farmers who had never been involved in industry activities, to those who were on the boards of various industry bodies. In addition, the sample also included a range of attitudes to farming, farm business management and pasture management.

We observed a continuum of business structures:

- Sole operators (<5% of respondents);
- Leasing or share-farming (about 15%);
- Family partnerships with the first generation in dairy farming still active;
- Multi-generation farms with family partnerships;
- Corporate-like family farms;
- Corporate family farms; and
- Corporate farms.

Corporate family farms, in which there was a formal legal structure were rare but there were a number of family farms (corporate-like) that had some similar characteristics with agreements around areas such as profit distribution and succession. The corporate farms were, comparatively highly systematised with clear priorities around capital gain, cash flow and labour management.

Farms with a multi-generational background were the most common structure, though we also interviewed a considerable number (20-25%) who had the first generation to enter dairying still active in the business. As with all categories, there is some blurring at the edges of these categories as some of the 'newer' entrants did have family connections to the dairy industry.

Those who were share-farming and leasing could be further divided into sub-categories, with some entirely new to the industry, others having support from dairy farming family members, and the remainder leasing off, or share-farming with, other family members.

The majority of farmers supplied to major processors, a few supplied to boutique cheese producers and a very few supplied to organic markets. There was evidence of increasing volatility in producer-processor relationships with a significant number having switched processors in the last two years, some more than once, and others considering switching.

Some of the main reasons for choosing dairying are below.

- Being one's own boss
- Liking to work with animals
- A preferred lifestyle for family
- A preference for outdoor work
- Not having to deal with people (at least compared to other forms of work)
- 'Just love dairying'
- Family expectation, such as 'It's what I know' or 'never really thought of anything else'
- An opportunity to build wealth

Feedbase management

Respondents cited a variety of things that they saw as personal or family achievements but common ones were producing 'good types' of cows in good condition, a neat and well-functioning farm, surviving, and growing (the business). People who came into the industry with comparatively little or no dairy background were especially pleased about surviving and growing.

Consistent with our expectation of more naturalistic (heuristics and intuition) decision-making styles, formal business plans were rare, though most people had at least some general goals. Furthermore, there was very little formal financial analysis, at least in the sense that economists would understand it with a focus on true profit (including imputed wages and capital costs) or return on assets.

Advisors were also recruited by RDP staff to participate in individual interviews. This category included private consultants (the majority), factory field officers from the major processors, dairy researchers, and other service providers. Again, there was not the information on the whole population of advisors to choose a representative sample but the advisors who were known by the RDPs to be influential amongst dairy farmers were targeted.

SURVEY TIMING AND CONTEXT

The findings from this survey need to be considered in light of prevailing circumstances at the time of the interviews. As discussed in Appendix 3, recent events can significantly affect recollections and intentions and so responses should be interpreted in light of these events. Interviews were largely conducted in Gippsland from September to mid-November 2016, in the Murray region from mid-November to mid-December and in the West from mid-February to mid-March of 2017.

The study started just after there was a significant reorganisation of extension programs in Victoria. The primary extension role had moved from Agriculture Victoria to the RDPs of Dairy Australia (DA). Some respondents were still familiarising themselves with the new system and learning how things would work.

Otherwise, there were four factors that understandably loomed large in the minds of respondents. First, 2016 was dominated by the price cut announcements from some processors and the consequent effects on cash flow. It was clear from interviews that cash flow is treated as a critical enabler and indicator. Therefore, we expected that the 2016 prices and announcements would have considerable effects on thoughts around changes to expenditure, plans for expansion and perceptions about the future of the dairy industry.

Secondly, the previous dry, hot and early summer (late 2015 into early 2016) was frequently mentioned, especially by Gippsland respondents, in relation to pasture and crop performance and feed availability. Thirdly, and related to the previous point, the recent

shortages and cost of irrigation water were significant issues, especially for the Murray Region.

Finally, the wet winter and spring of 2016 was frequently discussed by respondents in the Murray region and to some extent in the West. Associated problems include the inability to access paddocks, bogging, pugging, loss of cow condition and production, and additional physical and mental effort for farm managers and workers.

In general, we noted some decrease in concerns about the state of the industry through the later interviews, as changes were announced in the management of Murray Goulburn and there was increased optimism about prices having bottomed out. Additionally, increases in water availability placed downward pressure on water prices. Attitudes to industry issues are further discussed in Appendix 4.

CLIMATIC TRENDS

In order to place current seasonal conditions in context and to consider longer term climate trends, we analysed climate data for each of the regions. Averages from a whole data period (1900 to 2016), were compared with averages from 1990 to 2016 to see if the last 27 years have differed substantially from 117 years of measured climate data. Individual temperature and rainfall data for each of the interviewees' farms was constructed from nearby Bureau of Meteorology recording points, as held by the SILO system (for further details see <https://www.longpaddock.qld.gov.au/silo/>). Data were then aggregated to regional averages. Detailed tables and figures are in Appendix 5. Longer term changes in the distribution and amount of rainfall may be important factors when making decisions about pasture and crop species and varieties, feed purchasing strategies and grazing management. Additionally, understanding long-term temperature trends may assist farmers in managing HGF and heat-related stress in animals.

As expected, rainfall has decreased in recent decades, but there are regional differences. Of the areas studied, Gippsland, as represented by the interpolated climate data, had the greatest reduction in annual average rainfall (-5%), followed by Western Victoria (-3%) then Northern Victoria (-1%) when comparing 1990-2016 with 1900-2016 rainfall. This reduction in average rainfall may be a function of a reduction in the peaks of the higher rainfall years, which seem to have decreased in Gippsland and Western Victoria, since about 1980. That is, while there have been years of high rainfall in the last few years corresponding with La Nina events, these peaks were not as high as the rainfall received in past La Nina cycles over the last century.

Of greater importance than recent changes in annual rainfall was the variation in seasonal rainfall. The Murray region has had a significant increase in rainfall (6-24% on average) from November to February,

Feedbase management

while Gippsland and Western Victoria each had increased rainfall in just one month of summer (7% and 16%, respectively on average). A challenge across all regions was the reduced rainfall in autumn months (11-21% on average), which may result in a shorter growing season and feed deficits at critical times. Each region had lower rainfalls in October which may impact on water availability for irrigation more than feed production.

There was an increase in the number of days above 25, 30 and 35 degrees over recent years, which would have affected pasture performance. Furthermore, there has been an increase in the average temperature-humidity index (THI), which is a composite indicator of likely cow comfort (see Appendix 5). A score of more than 72 is associated with detrimental effects on reproduction, while 78 and above is associated with decreased milk production and 82 and above signifies serious risks to cow health and even life. All regions have increases in the number of days equal to or above 72, 78 and 82, though the Murray region starts from a higher base rate and so has a lower proportionate increase in high THI days. Gippsland has the highest proportionate increase.

These changes may have significant implications for feedbase management decisions, and we note that some farmers recognise this, though others think in terms of cyclical patterns.

ANALYSING ATTITUDES TO CHANGE

Decision-making and innovation in agriculture have been extensively studied in a number of ways, such as focussing on economic drivers, the context of decision-making, the structure of farms and the characteristics of farmers. There have been many attempts to bring some of these factors together to develop extension programs based on industry 'segments'. An example from work commissioned by Dairy Australia is summarised in Appendix 6. Segmentation is based on a combination of characteristics, attitudes, business orientation and social relations and can inform the design of extension programs and communication strategies.

Our analysis of the data was influenced by these approaches and categories, especially the work of

Waters, Thomson and Nettle (2009). We did not however, adopt such an approach, either generally or specifically, for four interrelated reasons. First, from this survey there was a wide variety of farmers and farm businesses and while many could be segmented, there were also many who would cross categories.

Secondly, we observed that attitudes and context can change, which may mean people 'move' segments over time. Nuthall (2009) notes that there is some evidence of personality plasticity, though it is not clear if change is influenced by maturation, experience or both, and there may be some age limits to the degree of change. Thirdly allocation to segments may be issue-specific with attitudes to adoption or change dependent on the proposed technology or practice (Waters, Thomson, and Nettle 2009).

Fourth, segmentation is a useful heuristic for extension workers and advisors, especially in designing targeted messages and programs, but as with all social heuristics, it can lead to typecasting and constraining and misleading assumptions about individuals. For this study, the focus was on identifying the key characteristics around decision-making and determining how those characteristics relate to each other, to management choices and to practice choices.

RECOMMENDATIONS

The recommendations in this report will generally contribute to four areas.

- Engagement and extension strategies to support decision-making
- 'Enabling' programs, that develop broader skills and knowledge and can then be applied to various issues including feedbase management.
- Research gaps
- Approaches to research (such as recommendation 1)

Recommendation 1: *That dairy extension workers and industry bodies be encouraged to draw on a select few segmentation frameworks which are agreed amongst key industry organisations and applied according to the particular issue or goal, rather than universally*

Table 1: Number of interviews in each Victorian dairy region.

Region	Farmer interviews	Consultant/ advisor interviews	Group workshops
Gippsland	52	7	3
Murray	50	7	2
Western Victoria	51	5	-

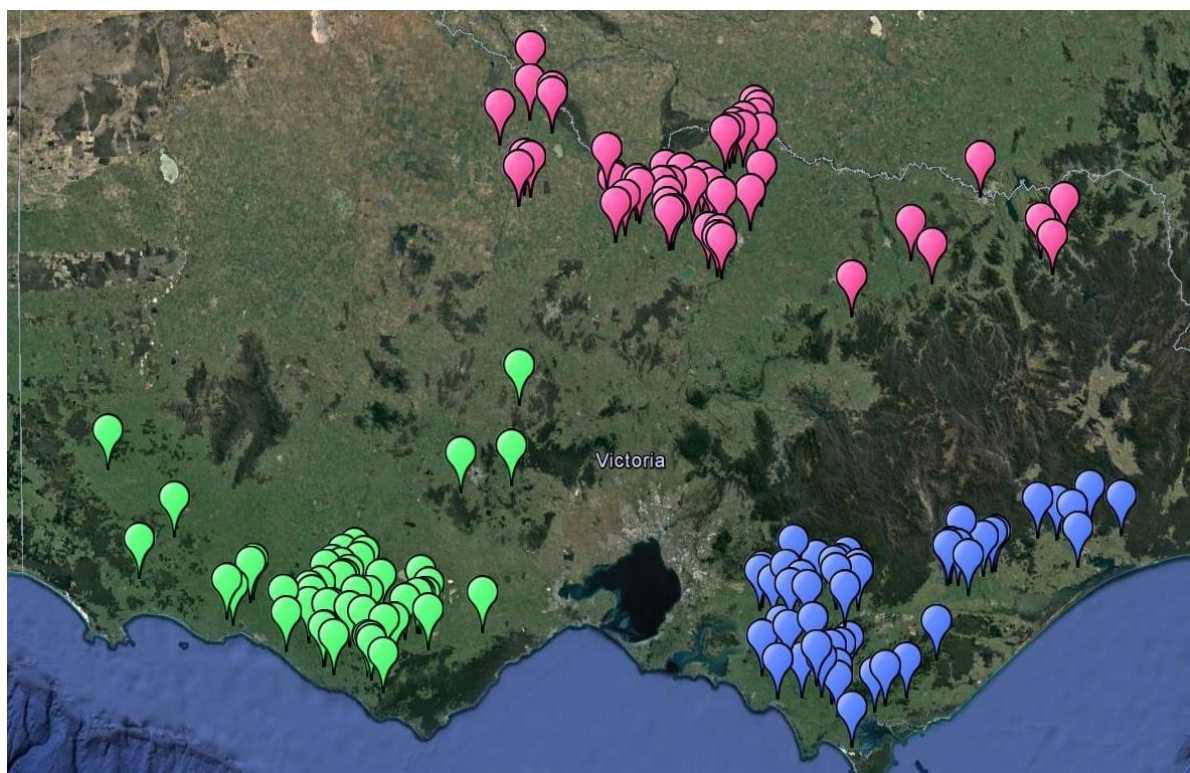


Figure 1: Location of interviews

Table 2: Characteristics of sample farms

Characteristics	Unit	Gippsland			Western Victoria			Murray		
		Median	Range		Median	Range		Median	Range	
			Min	Max		Min	MAX		Min	Max
Annual rainfall	mm	853	564	1105	736	625	1018	432	344	1017
Cows	no.	345	95	7500	300	82	5000	350	100	2300
Total farm area	ha	230	79	2800	260	83	2200	248	56	2000
Milking Platform	ha	123	40	1800	180	41	2200	130	30	1400
Stocking rate	cows/ha	2.7	1.0	5.8	1.7	0.6	3.0	2.4	0.6	4.5
Milk Production	1000kg MS/yr	160	50	4000	168	33	3420	178	58	1800
Milk Production/cow	kg MS/cow/yr	507	294	652	528	337	690	545	308	783
Supplement Fed	t/cows/yr	1.5	0.0	3.0	1.8	0.5	3.4	1.8	1.0	3.0
Time managing farm	Years	12	1	39	15	1	53	10	1	45
Time in Industry	Years	20	1	40	20	6	53	20	5	51
Employees	no.	1	0	79	1	0	56	2	0	35
Labour ratios	Cows/FTE	104	48	264	105	27	400	88	48	200
	Kg MS/FTE	54	23	119	54	11	220	49	21	113
Irrigation	% of farms	38%			31%			94%		
Discussion group partic.	% of farms	56%			47%			53%		
Completed Target 10	% of farms	44%			29%			25%		

2. FEEDBASE PERFORMANCE

As noted above there were prior contentions and evidence that many, if not most farmers could increase HGF production and it was assumed, including by most farmers that this would increase profitability, which was especially important with low milk prices.

The *Dairy Moving Forward* program established some pasture Key Performance Indicators (KPIs), including achieving 1 t DM/ha/100mm of rainfall and irrigation and total feed costs \leq 40 percent of total costs. An unpublished review of *Dairy Farm Monitor Project* (hereafter *Farm Monitor*) data reports suggests that a minority of farms contributing data achieved these KPIs.

Neal *et al.* (2009) showed that the biological potential for perennial ryegrass growing (not consumed) under optimised irrigation in New South Wales is approximately 21 t DM/ha in the first year after establishment. Farmers utilise pasture at an estimated 50-80 percent depending on pasture management, which equates to a pasture consumption rate of 10.6-16.9 t DM/ha. This rate is higher than what is reported, on average, from Victorian farms, but similar rates have been achieved on many farms in Victoria, particularly in the Gippsland and Murray regions (Table 3 and Table 4). More importantly, according to *Farm Monitor* data, some farmers are achieving higher rates of forage consumption (t DM/100 mm rainfall) than at research sites (Table 4 and Table 5).

All of the advisors we interviewed believed that farmers could generally increase both production and utilisation and the RDP boards and teams acknowledged the potential for, and importance of, increasing HGF production and utilisation.

From our respondents though, there were some mixed signals. The economic benefits of increasing HGF (either pasture, crops or both) were widely accepted. When asked what the farm management priorities were for the next couple of years, a frequent and first response was a statement about the importance of pasture management and 'just growing more grass', or increasing crop production.

In the self-assessment of HGF production and utilisation, there were large variations. Of the farmers interviewed, 65 percent knew or could estimate their HGF consumption rate (this was mostly calculated by a consultant or through participation in the Farm Monitor Project). About 40 percent of farmers had determined a target for potential HGF consumption of 30 percent, on average, which equated to an additional 1.8-3.0 t DM/ha, depending on the region. There was, however, a wide range in HGF consumption 'targets' of 0-210 percent (0-6.5 t DM/ha). It was likely that many of the farmers who were not aware of their HGF consumption rates had more modest targets of 0-10 percent.

There was some questioning of the marginal costs of increasing HGF, especially from those farmers on the fringes of the dairy regions, with relatively lower rainfalls. Additionally, in the Murray irrigation region, there were times when purchased feed was seen to be more cost-effective than HGF, depending on the price of irrigation water and the cost of feed.

The areas farmers nominated for possible improvement were:

- Fertiliser applications (timing and amounts);
- Timeliness of planting crops and pastures;
- Stocking rate and grazing management;
- Re-fencing for better paddock configuration;
- Drainage work; and
- Pasture and crop variety selection.

Some of these areas for self-improvement were also identified through the *Taking Stock* program (Webster 2017).

Those limited scope or reasons for change either in the near future or at all, cited:

- The system was manageable for the operator/s;
- The business was at the right scale;
- The business was profitable, which suggested to the respondents that feedbase management was therefore working well, given that feed is a key driver of profit; and
- There is one or more specific business or physical constraints (see later discussion).

Respondents were overwhelming, 'very' or 'reasonably' confident about their 'ability to get the most out of' their pastures. Pasture production is considered by most to be a key driver of the business and therefore a critical area to concentrate on.

Many respondents had changed from large to medium-framed cows over the last decade through cross-breeding Holsteins with smaller cows or selecting medium-framed Holstein cows. The reasons cited for changing from larger framed cows were: that farmers could not feed to the genetic potential of larger Holstein cows; to alleviate fertility problems; to reduce the impact of large cows on paddock condition; to have cows that were more capable of walking long distances, to overcome the physical limitations within the dairy; and to improve the components and quality of milk.

We were never going to feed them to their full potential so what the hell do we have these big, 600, 500 kilo animals for that are never going to be fed? (Gippsland dairy farmer)

Table 3: Home-grown feed consumption rates from existing studies.

Location	Feed/100mm water (t DM/ 100mm water used)		Home-grown feed consumed (t DM/ha)		Home-grown feed conserved (t DM/ha)		Source
	Range	Av	Range	Av	Range	Av	
WestVic CF (2005-2009)	1.0-1.4	(1.2)	7.5-10.3	(9.0)	0.5-1.2	(0.7)	Hill <i>et al.</i> (2014)
WestVic Terang (1995-97)		(1.1)		(8.3)			Jacobs <i>et al.</i> (1999)
WestVic improved RM	0.8-1.2	(1.0)	6.0- 9.0	(7.5)			Heard <i>et al.</i> (2012)
Murray MIS (1994-99)	0.1-1.7	(0.9)	3.3-19.4	(9.4)	-		Linehan <i>et al.</i> (2004)
Murray GIS (1994-99)	0.2-1.7	(0.9)	2.4-17.7	(9.2)	-		Linehan <i>et al.</i> (2004)
WestVic Simpson (1995-97)		(0.9)	5.3- 7.1	(8.4)			Jacobs <i>et al.</i> (1999)
WestVic RM (2005-2009)	0.8-1.1	(0.9)		(6.2)	1.2-1.4	(1.2)	Hill <i>et al.</i> (2014)
Gippsland	0.7-0.9	(0.8)	7.3- 9.7	(8.5)			Armstrong <i>et al.</i> (2010)
WestVic unimproved RM	0.6-1.0	(0.8)	4.3- 7.3	(5.8)			Heard <i>et al.</i> (2012)

GIS, Goulburn Irrigation System; MIS, Murray Irrigation System; Mod, Modelling was used to determine pasture consumption rates; RM, perennial ryegrass maximised; CF, perennial ryegrass with complementary forages

Table 4: Rates of home-grown feed consumed and conserved from the Dairy Farm Monitor Project (DEDJTR 2015; 2016).

Location	Feed consumed & conserved/100mm water used							Home-grown feed consumed (t DM/ha)				Home-grown feed conserved			
	2006-15			2015-16		2014-15		2015-16		2014-15		2015-16		2014-15	
	Range	Av	Top	Range	Av	Range	Av	Range	Av	Range	Av	Range	Av	Range	Av
Gippsland	0.3-2.0	(0.9)	(1.1)	0.5-1.3	(0.9)	0.4-1.3	(0.9)	3.6-12.2	(6.9)	2.8-11.9	(7.4)	0-4.0	(1.0)	0.2-2.9	(1.1)
WestVic	0.3-1.5	(0.8)	(0.9)	0.2-1.2	(0.7)	0.4-1.5	(0.9)	0.9-6.4	(3.4)	1.9-6.7	(4.5)	0-4.2	(1.5)	0-2.4	(1.2)
Murray	0.1-2.1	(0.9)	(0.9)	0.5-1.4	(0.9)	0.7-1.6	(1.0)	3.0-13.8	(7.1)	3.6-15.3	(7.6)	0-4.4	(1.1)	0-4.2	(1.2)
State-wide	0.1-2.1	(0.9)	(1.0)	0.2-1.4	(0.8)	0.4-1.6	(0.9)	0.9-13.8	(5.8)	1.9-15.3	(6.5)	0-4.4	(1.2)	0-4.2	(1.2)

Table 5: Pasture consumption rates as calculated or estimated on respondents' farms

Location	Feed consumed /100mm water used		Home-grown feed consumed (t DM/ha)		Percentage of farmers that responded (%) ¹
	Range	Median	Range	Median	
Gippsland	0.6-1.6	(1.0)	4.5-14.0	(9.3)	79
WestVic	0.4-1.5	(0.9)	3.3-12.0	(7.0)	47
Murray	0.4-2.6	(1.1)	3.8-16.0	(9.8)	71
State-wide	0.4-2.6	(1.0)	3.3-16.0	(8.7)	66

¹Most respondents who were unable to answer this question either did not estimate consumption rates or others did the calculations and the respondent did not know or recall the outcome at the time of interview.

3. FEEDBASE SYSTEMS

GRASS PASTURES

While there was considerable variation in the composition and management of HGF from our sample, perennial pastures were a common and major component, which was consistent with previous research and observation. Master *et al.* (2009) found that farmers were motivated to adopt perennial pastures by the potential to increase both productivity and profitability, as well as for other reasons, such as to combat salinity. The predominant pasture type in Australia, and amongst our sample, is perennial ryegrass because of its perceived high nutritive value and relatively long growing season.

Perennial ryegrass can persist for 20-30 years but previous observations have noted the need for re-establishment or over-sowing every 2-4 years (Fulkerson *et al.* 2007) or even over-sowing as often as annually (Garcia and Fulkerson 2005; McKenzie *et al.* 2004). Furthermore, the density of perennial ryegrass has been shown to decline over time when rotationally grazed by dairy cows (McKenzie *et al.* 2003).

Gains in plant breeding since the 1970s have largely focused on dry matter yield while progress on plant density appears to have stagnated (McDonagh *et al.* 2016). Given that perennial ryegrass yields above 20 t DM/ha can only be achieved under ideal, irrigated conditions with best-practice grazing management (McKenzie *et al.* 2003), and with concerns about seasonal and climatic conditions, some farmers interviewed for this project have sought alternatives in the form of feed crops and alternative perennial pastures.

So, traditionally been perennial pastures. And we have to oversow them every year, so you've got to go back and give them another twelve kilos, or spray them out and start again. So, we become tired of that... I think fescue's got a real future, at least for the next six or seven years until we hit ... whatever we produce at DairyBio... The fescues are deep-rooted, and they will persist; the quality is there. We're really moving from perennial ryegrass to a perennial base of fescue and lucerne. But they're harder to establish. (Murray dairy farmer)

Additionally, the warming climate may have affected pest populations which can decimate perennial ryegrass pastures, a concern expressed by a number of farmers that were interviewed. Common pests such as the African black beetle can cause significant damage to perennial ryegrass, even at low densities, often requiring the entire paddock to be re-sown (Esqueda *et al.* 2017).

Many respondents reported both perennial and annual ryegrasses having shorter growing seasons and more difficulty persisting than in the past. It is, however, difficult to determine how much persistence problems

are related to climate, management decisions such as stocking rates, or the combination of the two. When perennial ryegrass has not persisted, farmers may need to re-sow a large proportion of the farm, and in some cases, this was the entire farm. Where finances do not allow this to happen, some re-sow a combination of annual and perennial pastures and each year work towards re-establishing more perennial pastures.

Alternatively, farmers may choose cheaper, less productive varieties of ryegrass to offset costs.

It's not hard to grow grass, it's hard to keep grass. So, you've got to be able to know what you need to put into it to keep it there. So, you just treat it as an athlete, put the good stuff in and you'll get the good stuff back. And just keep it growing. (Gippsland dairy farmer)

Some farmers have developed very clear pasture variety preferences through the experiences of other farmers and their own experimentation. Others are however, quite cost-sensitive, especially in tight years. The availability of varieties at the time of a planting decision is also a factor. A number of the advisors commented on the influence of seed companies on variety selection.

I always would go for the better ones [pasture variety], the more expensive ones, the ones that flower later, giving you the longest possible season. The last couple of years because of conditions and income we've gone to the cheapest one and because we're sowing a lot more...we're just pretty much over-sowing most things now... Going for the cheaper grass is something I'm forced into. Having said that you don't want to be forced into that position for too long because then you end up with a short season farm.' (Gippsland dairy farmer)

ALTERNATIVE PASTURES AND CROPS

Numerous studies have shown the potential for farmers to increase their HGF consumption by incorporating alternative forages such as feed crops into their feedbase (Chapman *et al.*, 2008; Neal *et al.*, 2009; Hill *et al.* 2014). From our sample, there is increased experimentation with alternative perennial pastures and crops. For perennial pastures these alternatives include lucerne, chicory, cocksfoot, phalaris, fescue, prairie grass and plantain. While clovers are still used there has been a reduction in these with higher fertiliser use.

There has been some increase in cropping with maize and forage sorghum to utilise increased summer rainfall and to fill expected feed gaps. Other crops were millet, turnips, rape, oats, fodder beet, vetch, wheat, triticale and barley.

Look we're pretty high [pasture consumption rate]. 14 [t DM/ha]. Over 14 is pretty good but I suppose around that is just being, just maybe growing

Feedbase management

better quality. ... but you can only do as best you can in the summer with these hot, windy days ... the pasture you just see it wilting away. It's a bit depressing but that's where you see you've got this beautiful big summer crop so that sort of sets your mind at ease. (Murray dairy farmer)

A variety of feed combinations were used to suit the specific climate and amount of available water. When less water was available, such as for dairy farms in lower rainfall areas or when less irrigation water is available, farmers seemed more open to trialling alternative pastures. These farms were often larger and may have had sufficient area for some experimentation. Two of the key characteristics of adoptability are that the proposed practice, technology or feed source is 'trialable' and observable (Kuehne *et al.* 2017, 117), or can be incrementally introduced and observed, and we return to this point in later discussion.

Attitudes to large-scale cropping are strongly related to attitudes to machinery ownership and use. Some people like machinery work, whereas others clearly prefer working with cows. In addition, some prefer to keep capital costs low, while for others having one's own machinery means you don't have to rely on contractors. The complexity of the feed management requirements for each crop, for example with higher requirements for maize, will also influence choices.

BUYING IN FEED

We found that generally there is greater diversity of feed sources in the northern irrigation areas and in the more marginal rainfall areas of each region, for example the north of the Murray region, north and north west of the Western region and in the east of Gippsland. The 'peripheries' of the Murray and Western regions are also closer to grain and hay producing regions and farmers in those areas seem to have strong links to grain and hay producers.

Many farmers now feed to production using grain or other supplementary feeds, more so than in the past. Farmers in the western district feed more hay and silage than they used to, both purchased and conserved, which may be a management response to drier years. There is an associated cost with harvesting rather than direct feeding and a number of respondents noted the time and costs associated with feeding out. Some farmers had ceased using mixer wagons, while others were keen to avoid this form of intensification, because of the time and labour required.

It is changing though because now we would choose to conserve silage for \$205 a tonne, than buy northern hay for \$200, like I would much rather have the controlled environment where we have the area and it's ... available to us and if we want to we can maybe arc production up a little bit, but I like the idea that all our forage is grown on area that we control. (Gippsland dairy farmer)

The majority of farmers interviewed stated they had a base of pasture and fed more than 1 t grain/cow. Grain feeding has generally increased, though the amounts will vary somewhat depending on milk prices, grain prices, the cost of bought hay and assessments of available on-farm feed.

There are however, a wide range of views on buying in feed.

When you're looking at the higher levels, you're sort of talking about, oh that last kilo of grain, does it return this amount of milk. But it might not return that amount of milk, but it might return you extra fat on the cow, plus allow you to not have grazed that paddock an extra centimetre, and so, you'll get the return later on. (Gippsland dairy farmer)

Some of the very high producing farms are quite happy to buy in what they need to, to achieve that production even though it's not the most profitable system... and we've discussed it, they're still not going to change because they want to do that production... And they just can't see that if they drop their production that they'd actually be more profitable. It just – they can't accept so we've had a lot of discussions... so we tend to focus on pasture production and home-grown feed so trying to maximise what you can produce at home. (Western Victorian dairy advisor)

This theme of control of inputs was common, with concerns about relying on the availability and quality of hay and grain from elsewhere.

FERTILISERS AND SOIL MANAGEMENT

As expected, Urea is a major component of pasture management, with a common regime being applications after grazing, though there were variations on this. Then, farmers use different combinations of other fertilisers. Farmers are very sensitive to both fertiliser and milk prices and the non-urea fertilisers seem to be quickly cut if milk prices fall. There is a widespread view about fertiliser 'banking', whereby past applications are seen to build up nutrients in the soil, allowing fertiliser applications to be reduced or postponed in tight years.

A number of farmers in all regions, but more so in the West, have started using compost and other non-urea alternative fertilisers. There is a small but perhaps growing minority interested in 'biological' farming.

Soil testing is extremely widespread (>90%), ranging from annually to every three years. Different approaches are used for soil testing such as annually testing representative paddocks for each soil type or, for example, testing a third of the farm each year and completing soil tests for the whole farm in three years. Results are used to decide on fertiliser application strategies to address soil nutrient

Feedbase management

deficiencies, targeted to the soil type of particular paddocks.

IRRIGATION MANAGEMENT

More than half the respondents had some form of irrigation system, with more than 90 percent of the respondents in the Murray region heavily dependent on irrigation. Water policy and water security were issues of high interest and importance, especially in the northern regions. There were however, different perspectives on the management of water allocation policy. Some are strongly anchored to earlier policy arrangements, such as fairly predictable allocations 'per acre' and these provide a point of comparison and criticism of current policy. Others, usually younger, had more of an approach of learning to live with reduced water availability and greater price uncertainty.

I'm still optimistic that it is a viable industry and that but again my biggest worry when I come in was water and it still is now and I don't know whether it'll ever change to be honest. (Murray dairy farmer)

Similarly, there is a spectrum of views on operating in water markets. Some, usually the longer established, prefer to 'own' high security water and for two reasons. First, it provides greater security of feed production and secondly, it is an asset, along with cows and land that can be traded in, especially as 'superannuation'. At the other end of the spectrum, are people, usually younger and/or in their early career, where high security water is seen to tie up too much capital and so water is bought on the temporary market as a necessary input. In between are people who have sold high security water to use the capital for other developments, such as improved dairies, more efficient irrigation systems or property purchase. They may spot buy water but will also buy back high security water at the 'right' price.

Dad's very much been a perennial pasture man. He's done a great job of doing that but with ... not owning water and the water being at the price it's at, the return on, for every meg I'm putting on I'm growing 1 tonne of dry matter. Well at 280 bucks a meg... to only grow 1 tonne through the summer it just doesn't stack up and that's just with the water. That's without my labour, fertilizer and all that going in. So, it works out to be about 400 something bucks a tonne just to grow summer feed, ... it's not economical, it's ridiculous. (Murray dairy farmer)

Probably the big scope, myself and everyone else, is probably your pasture growth per megalitre is probably the one you're looking for. You want a species because we're – well science is predicting that we're going to be getting less and less rain,

thus less and less rainfall, less and less irrigation water. So typically if we grow a tonne of feed per megalitre, you need to be trying to push that out to two. And to me, fodder beets and maizes and those sorts of things are part of those equations and greater water use efficiencies from your perennial type things, that's got to be the big push. (Murray dairy farmer)

Irrigation, especially where there is a need to purchase water on the temporary market, adds to the management intensity of dairy farming, balancing water prices with hay markets, milk prices and HGF costs. On top of this is the need to consider how the availability and price of inputs will change with the timing of decisions.

Irrigation management is often a significant physical load for the primary manager. Almost invariably, this person did most if not all the irrigation decision-making and physical work, including multiple trips to the paddock during the night. There are several reasons for this:

- Lack of additional labour in the business, which is especially the case in early career or smaller-scale operations;
- Insufficient skills, or perceived insufficient skills in the labour force, considering the importance of 'getting it right' and the risks and costs of getting it wrong; and
- Difficulties in having paid workers do night time or fragmented work (in small, distributed chunks).

Innovations in irrigation systems over the last five years were reasonably common, especially with large-scale government initiatives such as the *Connections* project and *Farm Water Program* (on-farm). Even so, farmers take a relatively incremental and pragmatic approach to system change. Wholesale transformations, for example from flood irrigation to spray systems, were extremely rare. The key factors were:

- Capital cost, even where grants or subsidies were available;
- Issues to do with property layout and how parts of the property can be best linked to the system infrastructure. Gravity versus pumping requirements are important here;
- Concern about having paddocks out of production while the system is reorganised; and
- The cost of energy for the new system.

This last factor has implications for the adoption of 'water efficiency' programs, as from the farmer perspective, increasing water use efficiency may also lead to an increase in on-going costs.

4. DRIVERS OF CHANGE IN FEEDBASE MANAGEMENT

OVERVIEW

According to the respondents' self-assessments, most innovation in feedbase management, and management more generally, is through incremental and often experimental change. The major changes over the last five years have mostly been around water efficiency in response to reduced water availability and managing increases in scale of operations.

These changes include significantly increased cropping, decreased use of perennial ryegrass, increased use of alternative perennials (particularly lucerne and maize), building and using a feedpad and feeding under shade, though the latter is not yet common. The sum of smaller adjustments in what is grown, how it is grown and what feed is purchased, may however add up to considerable change over several years. For example, some respondents described their system as pasture-based, but in conversation it became evident that there was more diversity in feed production than first discussed.

I'm not convinced that I can grow permanent pasture here anymore in the old traditional permanent pastures. So that's why my thinking has moved completely. Fescues will be my permanent pasture rather than perennial ryegrass. Lucerne will be a part of a permanent, semi-permanent kind of operation and then Italians.
(Murray dairy farmer)

There were significant changes in other areas of the business, for example in land purchases, especially where nearby properties were available, new or refurbished dairies and changes to irrigation systems.

We identified a number of factors that have encouraged, or are likely to encourage, people to make changes to feed systems, and other elements of the business. These are:

- Seasonal conditions and climatic trends;
- Financial position and market signals (milk prices, water prices, debt levels and cash flow);
- Positive perceptions of the future of the industry;
- Being in, or considering a period of business growth;
- Generational change;
- The innovations of other farmers;
- Education, training and exposure to other systems; and
- 'Benchmarking' (broadly defined).

SEASONAL CONDITIONS AND CLIMATIC TRENDS

We observed that seasonal conditions and perceived climate change are drivers of practice change. Seasonal and multi-seasonal conditions have

influenced decisions on pasture and crop choices, purchasing feed and the application of water. We observed at least three broad responses to such conditions:

- Choosing pastures and crops that allow more short-term flexibility;
- Adaptation strategies in response to a run of poor seasons, where these changes, such as pasture and crop choices, stocking rates and purchasing feed, could be either short or long-term adaptation strategies; and
- Intended longer term changes based on the expectation of climate change and the need for risk management.

As noted earlier, responses to a changing climate were particularly evident amongst respondents on the peripheries of the dairy regions. This may be related to lower rainfall and having available land on larger properties that more easily allow for experimentation.

The reduction in rainfall, discussed earlier, can be disproportionate to the reduction in home-grown feed.

The reality is that if my rainfall drops by - well, last year - I'm just going to get rid of some of these figures: it was 623 mm instead of 777, but the total dry matter yield dropped from a 13.5 tonne to a 6 tonne. So, while it's a small decrease in the amount of rainfall, it's a halving in the amount of pasture I can grow and I look at that and think oh shit, what am I going to do and I don't see a solution to that apart from diversifying into something else other than dairy. (Gippsland dairy farmer)

In addition, the level of confidence in decision-making may decrease during drought (Shaw and Shannon 2013). On the other hand, good seasons may turn thoughts to the potential for capital reinvestment (see comments in next sub-sections).

FINANCIAL POSITION AND MARKET SIGNALS

There are three interrelated financial variables that can drive practice and system change, though the causal processes are multi-faceted, complex, situational and qualified.

Poor production or low milk prices can galvanise reflection on costs. Most respondents accept the idea that HGF is the cheapest form of feed, with some exceptions in the Murray irrigation region where the cost of water can lead to increased external purchasing of feed. As noted above, cash flow is overwhelmingly the primary indicator of financial performance on dairy farms in our sample. Hence this is another signal of financial pressure and can lead to adaptations.

Economic adversity is a good motivator - as harsh as that sounds... seen some massive changes these last 12 months. (Murray dairy advisor)

On the other hand, there can also be innovations that result from an improvement in prices and cash-flow.

Feedbase management

Whether people like it or not, that is the driving force, there is no doubt about that, people will expand if there is money in it and it will just stop, the development will just simply stop with current milk price, it's just really hold the fort. (Gippsland dairy farmer)

In summary, low prices can drive incremental changes to the existing system, for example in grazing management or pasture and crop choices, while larger capital investment, such as in feeding systems or irrigation innovation are likely more strongly linked to higher cash flows.

Similarly, many respondents saw business debt as a driver of innovation and good practices. It was seen as something that kept the decision-makers sharp and interested.

Another financial driver of changes in feedbase management is the cost of irrigation water, especially in the Murray Region. There were four adaptations to higher water costs, noted or revealed by respondents:

- Different pasture and crop choices;
- Variations to pasture shutdown and start-up times;
- Changes to irrigation systems (for increased water use efficiency); and
- Trading off between cow numbers, area irrigated, feed purchases and water costs.

POSITIVE PERCEPTIONS OF THE FUTURE OF THE INDUSTRY

Further to the financial signals, perceptions of the future of the industry are also important in relation to decision-making. From the survey, those with a positive view of the future were generally more open to changing practices than those more concerned about the future. Nuthall (2009) previously noted that a positive view of farming may also reinforce experiential learning.

Perceptions of the future should however be interpreted with care, as they can be disproportionately affected by current events and circumstances (the availability bias) and also are affected by career stage and personal and family issues and circumstances. Nonetheless, we observed that a positive view of the industry seemed to be an indicator of, if not a contributing factor to, willingness to undertake practice change and investments that have longer term benefits.

BUSINESS GROWTH PHASES

Though formal business plans are rare, most farmers could describe where they saw themselves in relation to scale and growth. The growth phases included:

- Undertaking or planning expansion through property purchase, dairy construction or refurbishment, increased irrigation area or similar developments; and

- Intending growth when industry conditions improved.

There are however, potentially important changes made in a 'consolidation' phase. In this phase, respondents were making a recently expanded production system work smoothly. This could include changing feedbase management to fit with increased area and/or cow numbers.

GENERATIONAL CHANGE

Another factor influencing an inclination to adopt or expand on new practices or systems is generational change or impending generational change which drives both capital expenditure (land, dairies etc.) and reflection on practices.

As you get older, I think one of the great challenges is to continue to adapt to new information. I mean I see it with my dad, he is a reasonably smart fella but do you think I can get him to get a rotation out of his cows. It drives me nuts. He moves them because they look hungry or they've finished in that paddock, and I'm like 'But you've got to be thinking, Dad, you need 35 days before they're back in there, can you pick 35 days up?' 'Oh, no'. Or he moves them just because he feels like changing their scenery... So, they're hungry there, and they're hungry there. I mean they might like to sit on that little sand dune up there overlooking the beach today. (Gippsland dairy farmer)

Some enterprises bring in external advice for a generational succession, which leads to greater reflection on goals and business management. Waters *et al.* (2009) noted that those in the farm business segment classified as 'growing for the kids' were generally larger business operations that had expanded to accommodate the next generation of families. There was also encouragement within the business unit for the incoming generation to engage in industry learning opportunities. We also noted that multi-generational farms that were 'growing' for the kids' were keen for the younger generations to engage in industry learning.

INNOVATIONS OF OTHER FARMERS

Learning from peers has long been considered an important driver of innovation in agriculture (Nettle *et al.* 2015). We observed a number of pathways for this to occur.

- *Mentor learning*, whereby early career farmers identify a mentor, who could be a family member, obliging neighbour or the property owner from whom they lease land or share farm with.
- *The role model*, whereby farmers identify someone they regard as a 'good operator', usually in an enterprise that has similarities in production systems, location and/or scale to those of the prospective innovator.

Feedbase management

- 'Along-the-road' observation, whereby the prospective innovator is assessing what others are doing as a series of 'experiments', so that what is seen to work over time, will come into consideration for adoption.
- Peer interaction at industry events. According to many farmers this is an important co-benefit to the main scheduled activities. There are also additional social benefits from such interactions.
- Consultant promulgation, whereby consultants identify practices they see as productive and profitable being undertaken by their clientele and then they promote these amongst others in their clientele group.

There are three implications of this for industry extension and research. First, some of these pathways are hard to see in operation and so people who may seem quite self-reliant, or even 'hard to reach' from an extension point of view, could still be benefitting from industry research and extension programs. Secondly, and somewhat less positively, it may be difficult for farmers to discriminate between the quality of peer-to-peer information. Thirdly, consultants are highly influential in the adoption of practices and systems, however, they don't, with some exceptions, necessarily derive these from primary research or extension programs.

I hate being in a room with a bloody Powerpoint projector and some goose standing in front telling me stuff. I want to be out there and seeing stuff on the ground...That is important – getting out in a paddock and seeing it and seeing what's going on, hearing the farmer's story, talking to other farmers about what their experience has been, getting ideas from farmers – that's what I think is most valuable when you get to anything and there's not enough of it. (Western Victorian dairy farmer)

If you want to get farmers relaxed and talking put them in a paddock. Put them in a room and they fall asleep. So, they'll most easily engage if they're actually in a paddock and can talk amongst themselves and listen to what's going. (Western Victoria dairy farmer)

EDUCATION, TRAINING AND EXPOSURE TO OTHER PRODUCTION SYSTEMS

Industry development and other educational programs can be very influential in changing farmer practices. Examples from our respondents included *Feeding Pastures for Profit*, the *Target 10* program (especially in Gippsland) and *Taking Stock*. Other programs that promoted change were on financial management, business programs and herd management. Crawford and Nettle (2014) identified changes in management practices on farms that participated in the *People in Dairy* programs or were clients of advisors who participated in the programs.

We noted a number of other influences that promoted change in farmers, such as taking a general business course, or participating in an industry course that aligned with particular interests. In addition, we noted that programs or travel experiences that provided opportunities for participants to see other systems, were very influential on some people. These opportunities included:

- Working in other industries before starting dairying;
- Working on dairy farms in other countries; which is increasingly common amongst younger people generally;
- Receiving an industry scholarship or award; and
- Participating in organised tours to other countries, such as to New Zealand or even to see rice growers in NSW.

There is however, also an audience for more conventional research information.

I'm a 'seek out a research paper and read research' type of person, and I think in the dairy industry that's not recognised enough. I think there's a line that farmers don't like doing that, and I don't think that's true with modern farmers. I think there's a hell of a lot of modern farmers – and I think a lot of people in the service industry don't realise how many research papers get passed around, get passed around farmers... I think there's a greater group of people that would be interested if they knew it was there. (Gippsland dairy farmer)

BENCHMARKING

Farmers 'benchmark', or compare themselves with other farmers, in at least four ways:

- Looking over the fence to see what neighbouring farms are doing;
- Using data from DairyBase or the *Farm Monitor* Project;
- Comparing with peers in a social circle;
- Comparing with peers in a discussion group; and
- Comparing with farmers seen as high performers, either regionally or by a farm type.

Industry benchmarks work through two effects. First, there is the *anchoring effect*, whereby the performance of others provides a comparative point for reflection on one's own performance. This was observed amongst some respondents. Secondly, there are some people, usually younger, who are energised by comparison and competition, and driven by the achievements of others. This competitive element is not for everyone and indeed there are some who do not want comparison or the implied criticism that may go with that.

Feedbase management

While the uptake by farmers of formal industry benchmarking, such as through DairyBase or the Farm Monitor Project is limited and sporadic in terms of participation, these can be important to some people, especially at particular decision points.

Discussion groups, which were the most frequently cited form of participative learning amongst our sample, can provide significant opportunities for benchmarking, especially where groups share business and performance information. Group persistence is however, highly variable, with some lasting for decades, while others have a more limited life of one to two years.

Discussion groups are facilitated by particular consultants, RDPs, or by farmers. There are many forms of discussion groups with some being more business-oriented networks that may span multiple agricultural industries, and others specialising in particular practices, such as for robotic dairy systems. Groups can be open or closed (restricted membership) and this will contribute to differences in what is discussed, especially relating to business and financial information. Some RDPs are trialling discussion groups that target people who, for various reasons, may not be participating in other groups.

In addition to benchmarking, groups also provide other benefits, such as social contact, reduced feelings of isolation, awareness that other farmers are facing common farming or personal issues, coping strategies for common difficulties, and learning about new practices and technology. Discussion groups as they are currently available are not for everyone, as will be discussed in the next section.

RECOMMENDATIONS.

Recommendation 2: *Industry bodies should continue to promote and where appropriate provide, opportunities for, farmers to increase business and management skills. This can include through education, training and learning about other dairy and agricultural and business systems.*

These opportunities could be coordinated around priority industry objectives. For example, tours, scholarships and training opportunities could, for a period of time, have clear connections to goals such as increasing profitability through feedbase management. Coordination around industry priorities is discussed below and in the Conclusions of the report.

Recommendation 3: *Industry extension programs be prioritised by seasonal and market conditions.*

Crawford and Nettle (2014, 7) have previously noted the importance of program availability 'at just the right time'. This already happens to some extent, with programs such as *Tactics for Tight Times* and *Taking Stock*, which were well recognised amongst respondents. There is however a case for including seasonal and market factors in an overall annual

planning process. A framework could be developed in consultation with an industry group (see for example Shaw and Shannon 2013) that specified that if certain conditions or critical factors occur, then particular programs should be run for farmers.

Recommendation 4: *Identify ways in which aspects of feedbase performance (and other) program elements could be, or continue to be, delivered through discussion groups.*

These program elements might best be tasters or introductions, rather than full programs, as it would be important not to overload discussion groups. We note that we had some very successful engagements by joining discussion groups for short focus groups.

Recommendation 5: *RDPs to identify situations where additional discussion groups might be set up to fill gaps.*

This might include creating groups with more reserved personalities, businesses at particular stages or creating or reviving particular types of engagements. There are different historical engagement models in regions and sub-regions that should be considered in developing these. RDPs are already doing some of this.

Recommendation 6: *Researchers and extension personnel continue to promote good practice, as demonstrated by well-regarded farmers, but ensuring these practices align with research findings.*

This approach could be developed from *ad hoc* promotion to be part of an annual strategic planning cycle, which could include case study vignettes for brochures or webcast material.

Recommendation 7: *Industry to consider formal mentoring programs, which could include coordinating mentor/mentee engagements and training and support for potential mentors.*

In addition to a one-on-one mentor program there could also be an 'inventory' of farmers with specific skill sets who are willing to help other farmers and who could be contacted on an as-needs basis for peer support and information.

Comment 1: *Further work is needed to determine how DairyBase might best be used.*

Uptake of DairyBase was modest, perhaps 25-30 percent of our sample, and existing data had mostly been entered by, or in conjunction with, consultants. While farmers were generally interested in the concept of DairyBase, there was a proportion of people who did not know anything about DairyBase. The largest impediment to using DairyBase was the time and skills required to enter the information. Stronger interest in DairyBase seemed to be generated when there was a critical mass of relevant data (similar location and/or similar farming system) already entered that farmers could compare their farms to.

5. BARRIERS TO PRACTICE CHANGE

We identified a number of barriers to farmers changing feedbase (and other) management practices, including:

- Cash flow and financial considerations;
- Concerns about seasonal and market conditions;
- Time availability;
- Labour availability and quality;
- Policy uncertainty;
- Farm layout and infrastructure;
- High self-reliance;
- Social and learning preferences;
- Stage of life or achievement (winding down or contentment with current state);
- Non-growth business stage of the farm business;
- Succession problems; and
- Risk averseness.

The three dominant impediments appeared to be: 1) cash flow and financial considerations, 2) available time to implement change and manage a different system and 3) limitations on labour availability.

Cash flow, financial considerations and seasonal and market conditions

There are a number of interrelated factors that contribute to concerns about short-term cash flow. These include, milk prices, debt levels and seasonal conditions, a key driver of income. A poor outlook, or uncertainty about any of these things will constrain the inclination to change practices, especially if there are costs involved.

From the survey, farmers wanted to be sure of a return on any money invested prior to changing their management or HGF practices. When the current situation did not provide an adequate return or where the situation prevented up-front funds being available, there was limited desire or incentive to invest. Additionally, it was difficult for farmers to make a decision if the return was unknown, such as the outcome of planting a combination of feed sources (especially crops) to increase production.

When you've got financial clout behind you, you can afford to have a dabble and make a mistake. When you are watching every penny, you're watching every blade of grass as well. So, you've got to try and make it work as best you can, and try not to make too many waves, because the money is not there for you to make too many mistakes. (Gippsland dairy farmer)

Along with an adequate return on investment, farmers wanted value for the money that was spent and in the case of capital works, to be sure they would pay for themselves within a certain time period.

Direct costs such as additional feed or an increase in irrigation water prices, are likely to increase with

unfavourable seasonal conditions. Additionally, when commodity prices are low, there is a relative increase in costs. Compounding these direct and relative effects, is the cognitive effects of recent events.

Particular concerns about current events are often heightened by *the availability effect* (see Appendix 3), whereby recent or important events loom large in decision-making. This effect can be particularly problematic for extension efforts. For example, some farmers tried particular crops and pastures at a time when conditions were unfavourable and experienced unwanted outcomes such as waterlogging of Some farmers were then deterred from trying the same crop or pasture in the future due to a perceived failure.

Time availability

One of the major constraints on innovation was time availability, especially for the primary decision-maker/s. From our survey, respondents generally had a work envelope of 60 to 80 hours per week, depending on time of the year and particular issues. While there may have been downtime within that, the nature of dairy farming, with relentlessly regular tasks, left only short blocks of time for rest or other activities. This was especially the case for smaller enterprises, early career dairy farmers and those with large, less-automated irrigation systems. Early career situations were usually associated with limited additional labour and could also often coincide with having a young family.

Therefore, the primary decision-maker must consider practice change in terms of:

- Effort involved in learning about options;
- Implementation time; and
- On-going time requirements.

The most important aspects of farming, as identified by advisors, experts and even some farmer respondents may not be what farmers spend the most time on. For example, although many farmers realise that they could fine tune their systems through additional strip grazing or grazing of a paddock if the residuals are too high in order to produce more HGF, they may not consider additional time requirements to be worth unfavourable changes in work-life balance.

Labour availability and quality

We regard labour availability and quality, and perceptions of those, as important areas for industry development. Labour was a common talking point, though attitudes varied widely. As noted above, the thought of finding and managing more labour is a barrier to growth for some people. In addition, labour turnover, shortages or lack of particular skills could influence the production system. That is, feed production and purchasing was adapted to available or the 'right amount' of labour. For example, some farmers chose to stay with perennials, or use contractors for reasons of lower labour requirements.

Feedbase management

There were widely varying attitudes to labour availability, skills and management. For some, workers were hard to find, unreliable and unwilling to do the kind of work or hours needed on a dairy farm. There may have been something of a locational effect here, with farms further from major centres or towns having greater concerns about availability. We do not however have sufficient data to draw conclusions on locational effects and this could be further examined.

At the other end of the spectrum, there were farmers who were very strongly focussed on people management, some particularly liking this aspect of the work. In these cases, there was more attention to some or all of: adapting the job for the employee; remuneration for retention; and a focus on professional development; workforce planning; and work activity planning.

... to get the lifestyle I have to be better at people skills and managing staff ... (Gippsland Farmer)

International workers were extremely important in some areas and operations, especially where local labour availability and quality were seen to be lacking. Some producers had well-developed pathways for recruitment and seemed to have preferences for certain nationalities whose values they considered aligned well with the business. These preferences may be a function of having developed particular recruitment pathways and contacts or of perceptions of particular national characteristics in regard to work.

Overwhelmingly, employees worked in the dairy, then some fewer in grazing management and with field machinery. As noted above, very few did high level irrigation management. Obvious exceptions were the large corporate dairies where employees also undertook management duties.

There was widespread use of contractors for particular tasks, such as silage harvesting. Views on this were split between those who preferred contractors because of the cost of owning and maintaining machinery, versus those who liked doing machine work themselves and who were concerned about the timeliness and cost of contractors.

Policy uncertainty

Ensuring water availability into the future was a concern for dairy farmers in all regions although farmers in the northern region had particular concerns around water policy uncertainties, as discussed earlier. Any talk of policy change, where that implies greater restrictions and higher prices is unsettling.

There were also some concerns about environmental policies, such as those relating to nutrient flows, and animal welfare groups and policies, though the effects of these on investment decisions and practice change were not examined in this project.

Farm layout and infrastructure

The physical layout and infrastructure of the farm often created barriers to changing practices and operation. From our survey, such factors included:

- Farm topography, especially steeper slopes and areas prone to waterlogging, which constrained grazing management choices;
- Dairy size, especially where farmers leased or share farmed. A new or refurbished dairy is a major expenditure and many respondents saw no point in increasing total production, and therefore cow numbers if the dairy size was a limiting factor;
- Lease or share farming agreements that specified herd size limits and particular pasture and soil management practices;
- Property shape, especially in relation to the location of the dairy, which influenced cow walking time and therefore herd and grazing management;
- Irrigation system capacity and physical reach; and
- Property size, especially in relation to potential to purchase neighbouring or nearby properties.

There was often a very strong theme of a constrained system in which great care must be taken to keep the components at just the right scale.

Dairy farmers in some areas, especially in Gippsland now compete with urban peripheral development, lifestyle farmers or other types of farming for land. The ability to purchase nearby land was especially pertinent for family farms that did not wish to relocate and therefore relied on the price and availability of neighbouring properties. Once land was purchased there were issues around access to out-blocks and the formation of paddocks and whether underpasses or re-fencing were needed.

High self-reliance

As noted by Waters *et al.* (2009) there are farmers who are, or appear to be, self-reliant in terms of seeking and accepting information (see Appendix 4), and our results support that. Themes from the interviews with these respondents included:

- Satisfied with own skills and sources of information;
- Don't want to share information with others outside the family/business;
- Don't want to be compared to others; and
- Being critical of, or having issues with, one or more industry organisations.

Some of the people with these views could fall into Jansen *et al.*'s (2010, 1299) category of 'reclusive traditionalists', strongly influenced by family lore and practices and perhaps a small group of peers.

Farm businesses with a strong orientation to stay at the same scale or with the same system, or to being

Feedbase management

highly self-reliant, are therefore, often assumed to not require extension services. It is understandably tempting to preserve extension resources, respect the privacy of the self-reliant and limit efforts at engagement. A number of advisors also believed that a significant proportion of farmers could not be influenced to change. Some farmers too believed that industry resources should go to the willing and the 'growing'.

We recognise the logic of those sentiments but would advocate for a more moderate approach, for five reasons.

- Industry programs may still be adopted over time by people with these characteristics through spillover effects from watching or interacting with other farmers.
- Circumstances can change peoples' orientation to external advice, such as new generations coming into the business or recognition of business problems.
- The issue of the levy is a sensitive one, especially in times of low milk prices and so engagement to some extent may be good public relations.
- Attitudes to industry bodies may change, especially as the RDPs are making significant efforts at engagement.
- Farmers might be being characterised as 'hard to reach' based on particular programs or fields of interest, and this might not apply across all areas of information.

Jensen *et al.* (2010) in relation to a study of responses to mastitis in the Netherlands, noted that assessments of being 'hard to reach' by providers may be relatively specific but that does not mean that farmers are hard to reach by other pathways. Some farmers might rather just be 'hard to directly influence', and only in relation to some issues.

Social and learning preferences

Overlapping with the issue of self-reliance, some people may have social and learning preferences that do not align with industry programs and messages. For example, there were a number of respondents that did not see discussion groups as having value for them and reasons for non-participation included:

- Not wanting to share private information;
- Not wanting to be 'criticised', and it was clear that some groups have quite a robust approach to benchmarking;
- Feeling overwhelmed by strong personalities, which might be especially an issue for early career dairy farmers;
- Who participated in the group or who facilitated the group;
- Having outgrown discussion groups due to groups not providing new information; and
- Not knowing anyone at the discussion group and not wanting to feel like an outsider.

... the other people in the group, none of them were after what I was after, they were all after mentoring in different things. (Gippsland dairy farmer)

Some RDPs are however, facilitating or creating discussion group variants, targeting people who may not be inclined to join other groups.

Stage of life or achievement

Amongst our respondents there were a number of people who were either winding down or were content with the scale, state and operation of their business and lives. These people often had relatively low engagement with industry activities and programs, either because they did not see the point of practice change or investment because of a short career horizon, or they were content with how things were operating.

From that latter group, several themes were apparent:

- 'It works so why change it?'
- Do not want changes that affected lifestyle and family commitments.
- 'I can manage this system'.
- An aversion to growth or increased production intensity because of the additional capital expenditure required or the perceived need for additional labour, which they see as hard to get and/or difficult to manage.

A number of respondents had tried different scales and settled on what they felt was the 'just right' number of cows as discussed above.

There also seemed to be an implicit logic for some that changing feed management practices could drive increased production which would then change the overall structure and bring with it the problems of managing labour and increased complexity of a new type of system.

Jansen *et al.* (2010, 1299) also identified farmers in the Netherlands who were 'comfortable with their own system', while Waters *et al.* (2009) identified a set of farm types that included 'winding down', 'family first' and 'established and stable' (see Appendix 4). These groups, as with some of our respondents, do not have a strong inclination to make major changes to practices or systems. Farmers nearing retirement were generally not interested in increasing their workload.

Non-growth business stage

We regard farm business stage as an important variable to be considered in targeting feedbase and other programs. This is different to the 'just right' and 'winding down' groups discussed earlier. It refers to businesses that have grown and/or are intended to grow again but for various reasons current investments are limited. This also excludes the short-

Feedbase management

term responses to prices or seasons, discussed earlier but refers to investment and expenditure pauses for reasons such as:

- Assessing medium to longer term industry prospects;
- Debt reduction or accumulation of savings for later expansion;
- A development period for the formulation of the next stage business plan or business objectives;
- Arranging a different ownership structure, such as family members joining or generational succession; and
- Complying with landholder requirements.

Farmers that were share farming or leasing were often constrained by their agreements as to what they could change on the farm. Farmers that were in the process of purchasing the leased or share-farmed property may not wish to improve it if that would affect the purchase price.

Succession problems

While succession was not frequently cited as a constraint on managing the farm business, where it was an issue, the effects could be considerable. Problems stemmed from:

- Negotiations with family members not directly involved in the business;
- Providing enough funds for retirement for the outgoing partners;
- Transition of management responsibilities;
- Filling labour gaps during transition; and
- Differing goals amongst the incoming generation, sometimes leading to property disaggregation or sale.

The effects of problematic succession can be far reaching and long lasting and it can be difficult for primary managers to have the freedom and capital to change practices and systems.

Risk averseness

Agricultural risk is classified as either 1) business risk, which encompasses the variability in cash flow from changes to production (such as seasonal or price conditions), as discussed earlier, or 2) financial risk, which is the risk associated with cash flow being unable to service debt (Sinnott *et al.* 2016). Farmers generally have more control over financial risk than business risk since they can limit how much they borrow, particularly when expanding the farm business.

Changing practices can have both financial and business risks, with additional expenditure, sometimes short-term losses of income and uncertainty about future income. On the other, the *status quo* can have risks. It has previously been observed that perennial pastures are seen as risky by many farmers due to the up-front cost and the possibility of pastures failing

to establish (Master *et al.* 2009). As supported by some of our respondents, there have been issues with the persistence of perennial ryegrass on many farms, particularly over summer where the dry, hot conditions contribute to poor persistence (McKenzie *et al.* 2004).

When a farm is expanding, especially through property purchase, the financial risk is initially high with less cash low expected earlier on than when the business is in a steady state (Sinnott *et al.* 2016). Benchmarking projects suggest that farmers considered debt to be the greatest barrier to expanding the farm (DPI 2011), with financial risk limiting the extent of growth. In general, we found that dairy farmers in our survey were reasonably risk accepting in terms of attitudes to debt and price volatility.

There were however, threshold effects, whereby once a particular debt servicing cost level, relative to perceptions of current conditions and future prospects was reached, then this becomes a constraint on spending and investment. This may mean, for example, that an increase in interest rates, could lead to greater caution about investment amongst farmers.

Risk preference has been found to depend on:

- Events and circumstances (Shaw and Shannon 2013);
- Age (Waters, Thomson, and Nettle 2009); and
- Gender (Waters, Thomson, and Nettle 2009).

There can also be generational differences in attitudes to risk, and this may be something that contributes to difficulties with the succession process. There are likely three effects on risk preferences from ageing.

- As people accumulate more assets, they have more to lose and people tend to inordinately weight asset protection relative to expenditure for future returns (see Appendix 3). In particular, major expenditure late in life may increase risks to what assets are available at retirement.
- Furthermore, older people have a shorter time horizon for the business and income and this would affect attitudes to what should be invested in.
- Finally, there is life experience, with older people having more experience of events, such as price slumps, policy changes, pasture performance and so on. This experience would affect risk preference.

Our observations, though limited, support the potential gender differences on risk. In general, the women who were interviewed, or their attitudes as ascribed by the responding male interviewee, were more cautious about large investments and spending during tough times and more conservative about cash flow management. There could be several factors involved here. The primary financial oversight is often

Feedbase management

undertaken by women who then have a greater knowledge of the situation and see the cash flows out of the business, which may have a cautioning effect. Previous studies of farmer decision-making have found that men tend to dominate major financial decision-making, though there is more joint decision-making around production and marketing (Kim and Cameron 2013, 85)

There may also be inherent or socially constructed or reinforced differences related to risk in general or preferences for adoption of technology and machinery. We did not have the data or scope to explore causality but the general conclusion, about gender differences on risk is important for understanding the farm business unit and for targeting for business management programs.

Perceptions of system compatibility also play into risk assessments. Sewell *et al.* (2017) found, for example that although New Zealand farmers recognised the benefits of implementing new herb pastures they also experienced barriers to adoption such as the ability to trial new pastures, the complexity of implementation and management, compatibility with the existing system and the risk involved (especially financial risk) in changing the system. Importantly, when farmers participated in learning sessions, these barriers were mitigated. Similarly in Australia, it has been observed that barriers to implementation can be overcome when the principles of pasture management are demonstrated in a practical way (Sloan and Ryan, 2006).

RECOMMENDATIONS

The first four recommendations in this section relate to what we consider to be very important enabling programs.

Recommendation 8: *Promote, or continue to promote and where appropriate, provide programs in, business management and leadership skills to support feedbase decisions.*

An understanding of business principles, decision-making and leadership are critical to feedbase management decisions, as identified by many of our survey respondents (see Appendix 9 on survey responses on research and learning needs).

Recommendation 9: *Continue and if needed, develop labour programs to build industry skills*

More and higher skilled labour availability will allow for greater specialisation of task management within the farm, which will in turn allow for greater attention to things such as feed production, grazing management and nutrition.

We are aware of the difficulties of attracting people into the industry and regional areas more generally, but this is an important area. In conjunction with labour availability is the importance of employee management skills in farmers to help manage and

retain employees. Relevant programs from DA include:

- The People in Dairy
<https://www.thepeopleindairy.org.au/>; and
- The Employment Starter Kit Initiative (ESKi)
<http://www.thepeopleindairy.org.au/eski-landing-page.htm>.

Recommendation 10: *Examine structures for, and attitudes to, labour hire businesses that could supply casual but well-trained labour.*

Given the difficulties of attracting permanent workers and the cost of such workers, there could be benefits in being able to draw on pools of skilled labour. This could provide labour at peak times or allow people from the business to attend training opportunities.

This recommendation should however be considered carefully and confidentially, given the problems with, and adverse publicity about, labour hire schemes in other industries such as horticulture. Note though, that this recommendation extends beyond just international labour hire.

Recommendation 11: *Examine if and how discussion groups might be supported to increase participation.*

This would require greater understanding of the dynamics of discussion groups, especially those targeting people who may not normally participate in other groups, considering:

- What makes them work?
- Who comes to what type of group?
- What are the barriers to participation?

We recommend trialling a system where farmers invite other farmers to participate in discussion groups, targeted towards people who have not previously participated in these groups. This already happens informally.

Recommendation 12: *Where farmers have a preference for the current operation and/or a high degree of self-reliance, then RDPs and other extension providers should adopt a 'keep in touch' approach.*

This would involve regular and low-key contact, occasional highly targeted information on matters of interest and checking on any changes of circumstance. This is further discussed in the Conclusions section.

Recommendation 13: *Research presentations and training programs should routinely include, in addition to financial analyses, discussion of the potential impact of changes on:*

- skill requirements;
- paddock availability;
- time requirements for the main business operator/s, both in the short and medium terms; and
- additional management requirements.

Feedbase management

The issue of research translation is further discussed in the Conclusions section.

Recommendation 14: *Where possible, continue to provide peer interaction time as part of learning activities, especially involving paddock settings.*



6. DEVELOPMENT PROGRAMS

Dairy Australia has established a number of Key Performance Indicators (KPIs) as aspirational targets for dairy farmers, as discussed in Section 1. It is difficult to determine whether farmers that are meeting these KPIs do so because they focus on the particular KPI or whether they have other skills (business, financial literacy, management, team building etc) that enable them to manage their systems to meet and exceed these indicators.

It was not obvious from the interviews that particular targets have much influence on thinking, though as noted above, comparisons with other farmers do influence some. On the other hand, as noted, there are those with little interest in direct comparison

The industry focus on technical measures has not brought about substantial change and existing research shows that technical measures do not necessarily correlate with profitability. Furthermore, there was concern from advisors around the accuracy of estimated pasture consumption rates due to differing levels of wastage that is commonly used when doing the back calculation.

PERSPECTIVES ON INDUSTRY PROGRAMS

While there was general support for industry research on feedbase production, there were at least three interrelated areas of contention that became evident through the preparation for the study and the responses from interview participants.

First, there were differences of opinion about where industry funding in general should be directed, as noted above. For some, levies were seen to be 'wasted' on administration or non-essential things, while for others, there were sufficient or more than sufficient benefits, including research, from that spending. The second area at issue was the targeting of extension programs. For some, programs should target those who want to learn or innovate, and/or were the 'future' of the industry.

Others, including RDP and other industry organisation staff, saw a case for seeking to engage the more self-reliant due to:

- A feeling of obligation related to the levy benefiting all who pay it;
- Concern about the future impacts of industry and policy trends; and
- The sense that more people could be willing to increase their exposure to research and extension.

The final area of concern related to the level of aggregation and cohesion of industry programs. At the start of the project, there was a strong argument for developing an industry-wide feedbase program, something akin to *Target 10*, with learning modules under one branded program. The arguments for this were the capacity to roll out consistent principles and practices, based on research, good recognition and

making a step-change in feed production. As noted below, *Target 10* did enjoy wide recognition and participation and was seen by many participants as transformative.

There are however, three factors that may work against a similar program, excluding any considerations of DA, RDP and Gardiner priorities and preferences. First, there was a strong inclination amongst farmers to see their farms as unique by location, climate or production system, implying that the application of common practices may not be that relevant. Secondly, there was a degree of feedbase diversification, as discussed earlier in the report, with more experimentation with crops and 'alternative' pastures, implying the need for more 'modules' within one overarching program.

Thirdly, there was the level at which any such programs would be marketed and publicised. Many respondents saw programs such as *Feeding Pastures for Profit* as only appropriate for early career dairy farmers and workers they hoped to develop. Many were keen to have 'higher level' programs. Whether or not the self-assessment of skills was accurate, this means that more experienced dairy farmers are unlikely to participate in a general program.

Target 10

Many of the project participants had completed the *Target 10* course and considered the course pivotal to their existing knowledge and farming practices today. There was some concern amongst farmers who had participated in the program and advisors that the next generation of farmers had not been through *Target 10* and may not have the same foundation of knowledge and skills. One farmer said about *Target 10*:

This is what we're trying to achieve, and this is how we're going to do it, and there's your pastures manual, here's your nutrition manual and here's your soil and fertilizer manual, and these are all working towards this clearly defined target. I think that's what helps so many people engage with it.
(Gippsland dairy farmer)

Feeding Pastures for Profit

Feeding Pastures for Profit was considered a very good course for farmers at all levels to learn or update their skills.

I did Feeding Pastures for Profit course and the tragedy of it was how little I knew of what the rye grass plant did and certainly no expert on it but you have an understanding that if you look after the plant the plant will look after you, and if we had continued farming the way we were farming 10 years ago we wouldn't have had to worry about last year because we would have gone broke.
(Western Victorian dairy farmer)

Feedbase management

Target 10 increased farmers' pasture management skills and *Feeding Pastures for Profit* continued to maintain and increase these skills. One perceived shortcoming of the latter program was that farm systems are changing and *Feeding Pastures For Profit* no longer addresses all areas of managing HGF, especially forage crops, managing alternative pastures and irrigation techniques.

For more experienced farmers, *Feeding Pasture for Profit* was useful, but seen to be at too low a level to produce significant change. Some farmers were after a higher level of information than they felt was currently provided to farmers.

There is a group of people sort of come up against a ceiling as far as grass production goes and grass consumption goes and they're getting frustrated because they don't know the next step... I remember saying a few years back... we've got nowhere to go. We've got no next step. There's no big step. (Gippsland dairy farmer)

There is a group of really information-hungry people out there, and I think we're provided with a whole lot of low level stuff because we're trying to service the whole sector. And they'll then lead from the front...at discussion group that's saying "Oh did you hear about this we should, we can extend our rotation and we'll get 10% more pasture". So I think that availability of technical information, of high level advanced technical information [is important.] (Gippsland dairy farmer)

Discussion groups

Discussion groups were quite popular in all regions but the usefulness of the group was determined by its focus, the mix of farmers that attended and the facilitator. Their limitations of discussion groups were discussed above.

The advantages were:

- Social engagement and especially support in tough times (Shaw and Shannon 2013);
- Benchmarking;
- Peer learning;
- Potential for mentoring;
- Learning about innovations and other farmer practices; and
- Exposure to actual farm businesses.

... discussion groups are real farms; real discussion. Gippsland Farmer

There may however be a need to stream groups. For example, discussion groups for high achieving dairy farmers could help those farmers more interested in the latest innovations to discuss ideas and find solutions to more advanced problems. Such a group

could also include service providers to try and maintain a level of skill amongst influential service providers.

Focus farms¹

Focus farms were seen as useful to participants and the format was well liked. Some people who were not comfortable attending discussion groups were happy to be involved in Focus farms. Focus farms were considered by early career farmers to be a good way to have feedback from a number of other farmers. The on-farm activities and peer learning were of particular appeal.

... your best education is seeing other farms work. (Gippsland dairy farmer)

Experimental farms

A number of respondents commented on regional experimental farms. These differ in function and management across regions but generally were not particularly well-regarded. In some cases, there were extensive comments on governance, but we did not fully explore this issue.

Themes included:

- 'not what they used to be';
- 'not practical enough';
- 'not a real farm'; and
- 'ok for the fundamental research' (implying extension is better done through other means).

We recognise that there were particular issues around each of the farms but we did not have the scope to explore those.

Promotion of dairy products

Farmers were hoping for more industry involvement to help Australian dairy products to be more competitive on the world market. Dairy Australia was also looked to in order to establish better trade deals for Australian dairy produce. More promotion of Australian dairy products was desired, such as 'clean and green' marketing internationally, or 'Australian made' produce domestically.

Industry structure

One farmer suggested an industry research study be funded that looked at the feasibility of dairy farming in each Victorian region and calculated what is viable in terms of the number of processors, milk supply and the dairy industry's share of water. This could then be compared with the current dairy situation to determine how compatible existing systems are and to target the areas that need further investment and development.

¹ Some respondents were referring to an earlier version of Focus Farms, not necessarily the latest format, but the responses were about similar aspects.

Feedbase management

Social license

We identified concerns among farmers around the image of the dairy industry in terms of animal welfare and the environment. The most common response to a question of 'what would you most like people to know about dairy farming', was about farmers' management of, and attitudes to livestock.

Don't be out there listening to this rubbish about dairy farmers are cruel. Milk apparently is murder. Come and talk to us and you will realise that we care about those animals and

you apply a bit of common sense you will realise that we have to care for them otherwise they won't provide to us, and that's a really important message... that has to be given to everybody about our industry. (Western Victorian dairy farmer)

In terms of work preferences or foci on the dairy farm, livestock ranked the highest with well over one third of respondents nominating this ahead of pasture management, machinery/cropping and people management.



7. COMMUNICATION, ENGAGEMENT AND EXTENSION

TARGETING EXTENSION

There are a number of reasons for pitching key information and training to larger groups of farmers. First, there are often common principles or practices that apply across the industry, such as in business, grazing management or herd health. Secondly, one-on-one advisory services are no longer funded as they were. Such services were an important part of industry and regional development strategies for many years, but these have been wound back over time. Thirdly, group delivery can have co-benefits, such as the peer learning and social contact discussed earlier in the report.

As argued earlier in this report though, there are many factors that can contribute to non-participation, during particular career or business phases, or more generally. One way to think about the farm business is as a socio-economic unit within a larger production and system. The business is the evolutionary outcome of countless previous decisions applied to the original resource base of particular climate, soils and topography.

Farms therefore evolve through 'punctuated incrementalism'. There are a many small (incremental) steps, such as selecting new pasture varieties, trialling crops, re-fencing, cross-breeding and so on. As noted early in the report, these cumulative decisions can lead to significant system change over time, something not always even recognised by the farm operators. That incrementalism is 'punctuated' by occasional step change, such as a new dairy, property purchase, a feed pad or a new irrigation system.

Extension and research workers are often interested in promoting step changes as means of responding to, or preparing for, economic and policy pressures. It is important to understand however, that for farmers, such changes usually require significant cognitive effort, considerable expenditure, increased business and financial risk and perhaps a change to the way the farm is managed.

FARMERS, HEURISTICS AND DECISION-MAKING

As the concepts and effects set out in Appendix 3 suggest, decision-makers tend to use naturalistic (rules of thumb) or *heuristics* that are drawn from experiences which may or may not match what is needed to resolve the problem at hand (Kenny and Drysdale, 2009). It has previously been observed that farmers apply a preferred set of tacit rules that are simple, cost-effective and appropriate for the farming scenario (Eastwood and Kenny 2009). This kind of decision-making is the norm amongst people and is practical and necessary, as formal and technical analyses of choices would be time-consuming and cognitively intense.

Respondents to this survey revealed some common applications of heuristics. With business management, cash flow was an early warning indicator of financial directions. While not an indicator used in formal economic analyses (such as return on assets, return on investment for capital expenditure, or true profit), it is popular because it is readily accessible (availability).

As one farmer put it, perhaps more explicitly than most:

The one I'm not interested in is return on asset. ... I might come up a bit with cash flows and budgets later but everything else, when you work with your own farm you tend to have most of it in your head... Return on capital, I find that a useless benchmark, especially in dairying ... if you want to be here you're here and then you can benchmark yourself... Gippsland Farmer

There are also other simplified financial indicators, such as a feed cost/milk price ratio. Other rules of thumb included the number of days between waterings at certain times of the year for irrigation management or sowing times based on time of the year and current weather conditions.

Such heuristics were especially evident in grazing management, with two broad approaches: monitoring cow behaviour; and visual assessments of pasture. Cow behaviour indicators included the speed with which animals left or returned to the paddock, how cows came into the milking area, the amount of milk in the vat, or how hard and where individual paddocks were grazed.

So, when the milk drops you know you got it wrong and the things they do running into the sheds, ... hunting grass on the way to the shed ... those sorts ... are also valuable for cross referencing, and also what's left in the paddock ... which is really important. (Gippsland dairy farmer)

For pasture assessment, very few farmers formally measure their pastures with a plate meter or other technology.

I now know how to measure pasture, so I've now learned up to your ankle in grass is twelve hundred kilos of dry matter...per hectare. And over your gumboot is three tonne. (Gippsland dairy farmer)

When I first started... we did measure [with] rising plate meters and that sort of thing but... your cows soon tell you. If you estimate there's enough there for an afternoon and you put them in and 3 hours later and they're standing at the gate looking at you, you know you've got it wrong. (Gippsland dairy farmer)

[I assess pastures] visually via cow days – cow days is the king. You can stick your dry matter. I used to do dry matter and got converted. ... I can

Feedbase management

do all the maths in my head. (Gippsland dairy farmer)

The other measurement I guess you go off is what's in the vat, you know where your quality's at from that sometimes as well, it's a pretty good indicator. (Gippsland dairy farmer)

'Approximate' decision-making may be quite logical, for as Pannell (2006) has demonstrated, a near-optimal decision may only have a small impact on payoff compared with the optimum choice. Decision-makers often have a large margin for error when making decisions and '(A) failure to optimize the decision will not be costly unless the decision departs substantially from the optimum.' (Pannell 2006, 557). Farmer decision-making often seems to occur intuitively and if payoff curves are flat, this method is sufficient and enables farmers to spend time on other areas of management (Pannell 2006).

The flatness of a payoff curve might therefore be more important than identifying the optimum management strategy (Pannell 2006).

I think we're probably at 80% to 90% of optimal. Trying to get that last 10% comes at a really high risk. (Gippsland dairy farmer)

I don't get bogged down with oh what's the best whatever – just give me a selection of a good price in that top 50 and that will do fine. I'm not precious about it. (Gippsland dairy farmer)

According to Gibb (2015), profit is influenced more by good farm management than by measuring technical profit drivers. Effective farm decision-makers follow a pattern of 1) identifying and focusing on two or three critical variables, 2) responding rapidly and decisively, even if the best option is not available, 3) being prepared and proactive and 4) knowing that in hindsight some decisions will turn out to not be ideal.

Within this framework, good managers also recognise that doing nothing can be the right choice and that over-analysing choices instead of acting can lead to missed opportunities. Therefore, management skill can be summarised as being able to make reasonably good decisions promptly. The difficulty for farmers is to know whether to hold out for the best and most profitable choice, or to make a timelier decision in situations where these two choices are not aligned (Gibb 2015). Farmers need to be flexible in their decision-making and to change with conditions.

I think if there has be a bigger emphasis on timing I suppose – so much stuff is time related – you can read it but if you don't do it at the right time you do miss the boat. I don't know how you can teach that [to] people but I think it's something you just learn. It gets talked about at discussion group and I know here I'm like a few days late doing something it will impact weeks down the track – rightly and wrongly. (Gippsland dairy farmer)

It comes down to for me learning when, the difference between a good decision and a bad decision is about a week and you get locked into, you go through, you go through the winter and you're struggling for feed and you've been so long without feed that you come into spring and you sort of oh you hang onto it for a little bit long and then you've lost quality and it's those little shoulders of every decision that costs me and by the end of the year that could be 2 or 3 ton over the farm. So, learning those critical times to make the decisions and fine tuning that as far as pasture goes. (Gippsland dairy farmer)

There are however, at least three limitations on intuitive decision-making (see Appendix 3 for more discussion).

- Overconfidence in level of skill or knowledge, given the limits on our memories and maintenance of skill level. Confidence is absolutely critical to being decisive but it can have a blinding effect.
- Poor 'calibration' over time. That is, farmers may learn technical skills and then develop heuristics for evaluating animal health or pastures, but over time the gap between intuitive performance and technical potential may increase.
- Patchy or incomplete recollection of events and outcomes. Management is based on experience, which in turn is based on memory and yet our memories can be incomplete, as we focus on particular events or mentally 'rewrite' history.

Hence, there are good reasons to challenge assumptions and practices based on 'experience'. The more structured and scientific thinking that drives research can therefore be an important part of developing 'intuition', which is derived from learning and repetitive application.

Intuitive thinking can however seem quite different to the scientific approaches to decision making, which are more structured and objective (Eastwood and Kenny 2009). There is also a potential mismatch between the goals and ways of thinking that farmers have, and what researchers and industry service providers assume are farmers' goals. For example, there is an industry focus on productivity and profitability, which is not always the main goal for farmers, or at least not the only major goal.

The problem is, there's only... about 20% of the industry that's engaged with money. The rest of them are engaged with other things so their aspirational goals are more time with their family or their environment, the cows – so, telling them they're going to have an extra \$40,000 doesn't necessarily equate...It's not a driver for them. (Western Victorian dairy advisor)

Feedbase management

Davis-Brown and Salamon (1987) developed the popular yeoman-entrepreneur typology which has evolved from different styles of thinking. These classifications match what is described in Australia as traditional or business-oriented types of farming and are typically seen as contradictory farming strategies.

Traditional farming is usually associated with small farm scales, continuity of farm management style over generations and risk avoidance, whereas business-oriented farming is more aligned with scaling up to larger farms, maximising profit and a dependency on the market. There can also be transitioning between the two styles of thinking (Niska *et al.* 2012). Farming styles may change through education or experience, potentially resulting in a conflict in management styles, such as younger farmers advocating entrepreneurial management techniques to a parent with a traditional approach to farming (Davis-Brown and Salamon, 1987).

As one of the field officers from Murray Goulburn said, he said you'll do alright because you haven't got years of preconceived ideas about how farming is supposed to be from 30 years ago. You'll do it how it's done now. (Murray dairy farmer)

While farmers may see themselves as traditional farmers (Niska *et al.* 2012), industry programs are more oriented towards a business-oriented approach. There may then be an unconscious industry bias towards business-oriented farmers because these farmers think in a similar way to extension and industry people, making communication easier. On the other hand we noted that a number of farmer respondents also argued that the business-orientation of industry programs was the logical approach.

THE RELATIONSHIPS WITH SERVICE PROVIDERS

Service providers can be extremely influential on feedbase decisions. As expected from previous studies, trust is a key determinant of who farmers take notice of. Farmers are likely to trust the people closest to them, who they see most frequently. Trust can be built between farmers and industry bodies through regular contact with Extension Officers and other people from the RDPs.

Consultants have direct input into decision-making, although the degree of engagement varies from regular engagement to running a check on the business every few years to being called in for particular circumstances, such as a major investment or succession. Those who use consultants look for someone they feel compatible with, which sometimes involves trialling and switching.

Consultants provide at least three things to farm businesses:

- Structured and reflective thinking that farmers can be too busy to engage in;

- An external 'review' of the business, free of the 'traditional', emotional or family constraints; and
- Information on what other farmers are doing.

Consultants are a very important means of circulating what they see to be the practices of successful farmers. Previous studies have concluded that advisors engage in pattern matching and fit advice for context (studies reviewed by Reid, Gray, and Bruce 2013). The assessments influencing the eventual advice include land type and suitability for enterprise, farmer 'type' and comparisons with other farms in the region. Our sample all have farmer types in their minds and are, in their own minds, 'problem-solvers'.

Some consultants also have broader roles in running industry programs and the choice of consultant is a factor that will influence farmers' decision to participate or not.

Use of consultants can however, lapse over time and it seems to be an expense that is seen by some as dispensable in tight times.

Commercial service providers can also have some influence, though attitudes to them vary considerably. Influence pathways include:

- Product recommendation, such as seed varieties, feed mixes or fertiliser choices;
- Pointing out what other farmers are doing; and
- Delivering industry programs.

While there is a level of wariness about commercial service providers, individual relationships have developed a level of trust over time.

The feed rep we've got at the moment is pretty good but you've got to be careful that they don't have an agenda. (Gippsland dairy farmer)

Nonetheless, many farmers are influenced by service providers and will go to service providers for information and advice. Therefore, it is worthwhile establishing relationships with service providers and providing them with the latest information and research that can be passed on to farmers. Murray Dairy has trialled an Agronomy Network to build relationships with relevant service providers who work in the region.

In particular, many service providers run discussion groups, information days and training sessions, some of which duplicate or almost duplicate the work of extension providers. Collaboration with service providers would be beneficial to reduce the resources dedicated to running events and to help boost farmer numbers at events.

A program for transitioning between service providers would also help to establish some continuity in the processes and information that both service providers and farmers receive. The majority of service providers interviewed did not keep up to date with the latest

Feedbase management

research and in some cases, they were not aware of the large body of research that was available.

COMMUNICATION PREFERENCES

We asked about how people received information about dairy industry programs and information and how they preferred to receive information. As with other aspects of management, those things that more easily fit in with the working patterns of farmers had greater acceptability, though individual social engagement preferences also mattered.

Aside from talking to other farmers or experts directly, the most, though by no means overwhelmingly, preferred communication mode was brief texts with links to further information. Then the recipients could decide whether or not to delve further into the issue.

One of the least preferred pathways, somewhat surprisingly, was email, and there were two things noted against it. First, it is less instant and available than text, and secondly, email accounts are now so clogged up with spam and competition for attention that an industry email is just one more message to set aside or junk. However, industry emails were still read or at least checked by the majority of participants.

For those engaging with communication technologies, phones and tablets were preferred over computers, for portability and flexibility. This also suggests the appeal of platforms for simple decision support applications that can be carried out in the course of a work day.

Hard copy material, including newspapers and industry journals remained important for some, as these could be read over lunch or morning tea.

In relation to those farmers who seemed to be more self-reliant and less engaged with industry activities and programs, some of the contributing reasons may have been:

- Being unaware of the information and resources available to them;
- Being discouraged by the gap between current practices and aspirational or example farms used for extension purposes;

- Not requiring further information at a particular time; and
- Being at or near retirement and unaware of industry information available on options such as succession.

Farmers may be more likely to engage with industry in the future if existing links are maintained through contact with extension staff. Initiatives that encourage farmers to invite other farmers may also be more successful at drawing the less engaged farmers to industry events or training.

Holding events at farms that are 'improving', rather than being at a peak, in addition to events at best practice may prompt more change than presenting just best practice alone. An improvement in targeting events for farmers at specific stages may be required because one event is unlikely to meet the needs of all farmers.

I think we need to realise that everyone's at a different stage and every farm is different... When we have ... open days we're at very fancy dairies... When people are depressed and you go to best practice it's often really hard... So, I think sometimes we have to be very careful where we hold events and send farmers, because you could probably become pretty disheartened. So, say for example we're doing heifer management and you went to some place that does everything gold star, and you're doing nothing. (Murray dairy farmer)

Farmers with different levels of management skill need to be approached differently. A 'one size fits all' to extension has not been shown as effective when trying to communicate with farmers who are less engaged with industry or who do not practice best management techniques. These farmers can become discouraged by seeing farms with the best practices and may be discouraged from changing as the state of these farms may seem to be unattainable. This may also be an issue with discussion groups, especially those that are quite robust in discussing aspirational targets.

Farmers also want to see farms that are similar to their own and currently managing similar problems.

8. PERSPECTIVES ON PERSONAL LEARNING PRIORITIES AND INDUSTRY RESEARCH

There were a wide range of views on the availability of information, from 'there is plenty, and you just have to look', to 'there has been next to no research done'. Perceived deficiencies may however have several different aspects:

- High self-reliance and so limited interest in searching for information (as discussed above);
- Alerts to information may come via non-preferred communication channels;
- Limited time to search;
- Ease of use of information systems. Some respondents reported difficulties in searching websites, including that of DA; and
- Research may not be seen as applicable to a farmer's particular situation.

Waters *et al.* (2009, 18) also found varying views amongst their respondents on the availability of information and a preference for 'regionally focussed' information, relevant to the current industry context.

Many farmers stated that more information was needed in an area where research already existed or was currently being researched. Farmers were often unaware of the research that is available or of existing resources that might be accessible through Dairy Australia. Numerous farmers stated there was a need for better communication of research findings.

The one thing I think about all these research projects and stuff is how often do we find out the results of it? You don't often – even as simple as the stuff that we do locally here, I think we never hear about the results of all the really good research. And I know they say with the genetic stuff, and the Good Bulls Guide; all those sort of things are obviously what comes out of research. But very rarely do you even know when there's pasture trials going on, and what the research is for. (Gippsland dairy farmer)

Communicating research to farmers is important for the industry to gain the full benefit from the research. The existing methods of communication do not seem to be reaching a large number of farmers.

I think we've got to challenge to get that knowledge out. I don't have the answer. I think [in] this country probably it is through the advisors. You've got to educate the [name withheld] and the agronomists and people or the rural store managers. I think too many [of] our dairy farmers are a non-educated tertiary group of people. You go to New Zealand they are all nearly tertiary educated. So, you've got this extreme difference in how you uptake knowledge. (Gippsland dairy farmer)

Additionally, some farmers found research from overseas, especially New Zealand, useful and wished there was better communication of overseas research.

Most of the advisors that were interviewed did not use current research to source their information, as noted above. Some advisors believed that research in particular areas was limited or lacking (such as on alternative forages) when there were hundreds of recently published papers available.

There were some comments about the importance of general education to support decision-making. This included interest in support to understand the ramifications of decisions and the relevant science. Another area of interest was having results replicated on farms, specifically with conditions similar to where farmers are located. In addition to this, some wanted to know how they might set up trials of their own.

The issue most cited by farmers as needing more research was the persistence of perennial ryegrass. Farmers wanted pastures that were more likely to survive in drought, waterlogged conditions, frost, sandy soils or with pest burdens. There was interest in better pest management techniques and the development of genetically modified ryegrass and clover. There was demand for more information on identifying better proven pasture species and developments in grass varieties, though there is already a significant amount of industry effort on these things.

Some respondents wanted to know more about growing feed to be eaten at the right time, while maximising feed within the whole rotation.

Many farmers had started adapting to climate change conditions by finding solutions for poor persistence, including alternatives to perennial ryegrass (lucerne, chicory, fescue etc.) or the use of mixed species planting. Farmers wanted more research or the communication of existing research in these areas, especially, learning about the best type of feed to grow for particular climatic conditions.

Farmers required information on the cost benefit analysis of changing their farm system or their management. Specifically, research on introducing automation or technology was sought, especially remote monitoring of pastures, automated milking, computerised feeding, collars for health monitoring, virtual fencing, robotics, drones and greater use of solar power.

Other cost benefit analyses that farmers wanted were arguably in areas they could calculate for themselves, given the right training and information. These were: an analysis of profit and pasture production, forage versus cut and carry, or the use of alternative pastures, crops or purchased feed. The information sought was however not always obviously available, such as the growth curves of different crops and

Feedbase management

pastures, performance effects on cows when swapping between different types of feed or the impact of water on different pastures and crops.

Research on the water efficiency of various pastures and crops was considered important in all regions, as well as the most efficient plants to grow (maximum yield/ML/\$). Better irrigation techniques were sought, especially for alternative pastures.

Many farmers also mentioned wanted to know about, research on cow performance and genomics, with some linking this to feed production decisions. Heat sensing and management were frequently mentioned, as were various other aspects of animal health.

Soil condition and health were popular areas of interest and this was also noted when respondents were asked about the priorities and practices. We think this may be an area of increasing interest, with potentially much to be learnt from research developments in the cropping industries. There was also some related interest in effluent management, for soil improvement and waste management.

Farmers were concerned about people being able to enter the dairy industry and thought that research around options to assist new entrants would be beneficial.

Methods of engaging farmers to use best practice management techniques was considered important, albeit difficult to solve.

As noted above, many farmers were suspicious of information from companies trying to sell products and wished for independent research and independent soil/feed testing to help them make decisions around their HGF.

Many of the topics that farmers thought important in terms of making more information available were related to a drying climate, less water availability and more volatile conditions. Risk management research was seen as important in an environment with greater climate variability.

Kenny and Drysdale (2009, p.25) noted, 'It is clear that any enterprise that combines climatic uncertainty with economic uncertainty through exposure to global markets will be exposed to a range of risks and hence a suite of complex challenges' (Kenny and Drysdale,

2009). The demands on farmers, such as the volatility of markets, animal welfare and environmental standards are increasing (Darnhofer *et al.* 2009). Dairy farmers have also experienced declining terms of trade which have been managed mainly through productivity improvements (Garcia and Fulkerson 2005).

Complexity is not a new development in agriculture, having been observed since the 1970s (Bawden, 1990) but the cycle of 'peaks and troughs' that farmers experience has been observed anecdotally to become faster, making recovery from poor seasons more difficult. It could be argued that the decisions that farmers make today and their decision-making ability have a greater impact on the long-term outcome of the farm business than in the past.

It used to be that you could go through and do a good job at farming and the money would be there. And that is old school – even though I did an Ag Sci and we did all the farm management papers and all about finances and watching your money you would have a bad year but you carry that bad year to come into a good year but we've now got the margins and I used to remember eight good years, two bad years – that's sort of flipped around...we don't have those margins to recover.
(Gippsland dairy farmer)

One of the challenges facing any business is knowing at what point the complexity of a business (whether products, services or processes) is optimised to maximise revenue and profit (Gottfredson and Aspinall, 2005). Farmers constantly balance the complexity of their farm businesses with profit outcomes and work-life balance. A decision to increase complexity, (e.g. adding a new crop or starting an irrigation program) adds complexity throughout the business by impacting on other decisions and processes and requiring new sets of skills.

Every day you're sort of, you're trying to play that game of chess, which is farming, you're trying to balance the weather with animal health, with cow production, with sustainability, environment, everything. You're trying to get that balance.
(Gippsland dairy farmer)

9. SUMMARY AND CONCLUSIONS

Feedbase researchers, industry leaders and farm advisors see potential for significantly increasing the production of home-grown feed, even just applying available knowledge and technologies. Many farmers acknowledge the potential for improvement on their farms, even having goals of increasing production. There are however, both short and long-term barriers to adoption for performance improvement.

Farms are socio-economic systems, within larger industry and regional systems, that have developed characteristics that constrain, or are seen to constrain, current operators. There is a particular natural resource base (climate, soils, topography) that has developed as a result of countless cumulative (incremental) decisions over generations. The current operator has been shaped by his or her family background and work practices and has a particular personality and work and life preferences.

From the farmer's point of view, there are logical reasons for caution, considering financial, labour, time and infrastructure constraints, as well as uncertainty about the best course of action. We also noted concern about previous recommendations that were at the time seen to be beneficial but were superseded by later and contrary research and experience.

It is important to note that many farmers believe they have the right scale and type of operation – it is manageable for them. They are therefore reluctant to disturb what they see as an equilibrium. The problem for industry research and extension staff is that they often see the risks in equilibrium and want to encourage change, sometimes quite rapid and significant changes.

Added to that, research and extension information and recommendations are often based on reflective thinking and specific outcome benefits, whereas on-farm decision-making is more based on heuristics and consideration of many potential effects of a change.

Hence, we see a key role for industry bodies in developing and implementing strategies that bridge these potential communication gaps.

As discussed in the report, we see industry 'enabling' programs as an important foundation. The aim is to embed practices and responses that become part of the farmers' fast thinking. In particular, the development of business management skills will help feedbase management through:

- Investment appraisal;
- Understanding marginal costs of decisions;
- Trade-off analysis;
- Identifying thresholds, such as water and feed prices; and
- Identifying where the most gains are to be made.

Labour programs will enable greater on-farm specialisation through a greater pool of skills and

better management and development of labour. In addition, labour-saving technologies are not just important for the particular task they enable but in freeing up time for management or better work-life balance.

Feedbase foundation skills programs are important for increasing worker and early career dairy farmer skills. These may also be important for experienced farmers but with the perception of programs such as *Feeding Pastures for Profit* as being about 'basic skills' there is a need for other strategies to provide refresher programs. We think these may be integrated with the release of other innovations in feedbase management. For example, releasing results from ryegrass trials could also include some refreshers on pasture management.

Peer learning is a strong and enduring preference amongst farmers. We therefore recommend:

- Continuing to build paddock activities into industry programs;
- Working through, and if affordable, expanding the Focus Farms program;
- Working through existing discussion groups;
- Filling discussion group gaps with different types of groups appropriate to target groups, regions and sub-regions;
- Encouraging and facilitating mentoring; and
- Providing and highlighting case studies of successful practice change.

Over the top of this, we also recommend a system of coordination of engagement and activities. The foundation for this, is the RDPs direct engagement with producers and their understanding of the people and business. We recommend a continuation of the efforts to identify and contact people, noting key characteristics such as:

- Preferred communication mode;
- Social relationships;
- Which other farmers they consider as models;
- Work and management preferences and interests;
- Business stage/goals;
- Risk preferences (in general);
- The generational mix and potential changes; and
- Learning styles, which vary amongst farmers (Nuthall 2009, 433).

Ideally, the Salesforce database could be used for this, however the data maintenance requirements may be too difficult to maintain so something simpler may also be needed.

This profiling and personal contact will enable the frontline extension staff to encourage people towards the appropriate information and programs. This is not advocating a return to one-on-one extension advice but is about personal contact to enable other forms of groups or broader engagement.

Feedbase management

On top of all this, feedbase and other programs would benefit from industry-level coordination. The first form of coordination, in which key players including Gardiner Dairy Foundation could take a lead role, is identifying the practices that, based on sound research will yield the most benefits. These would then become priorities that are promoted through the program and extension infrastructure, such as discussion groups, *Focus* farms and so on.

The second coordination role, most probably resting with DA and the RDP, is in managing the now very crowded dairy 'calendar' and prioritising programs and program foci according to:

- Industry extension priorities as above;
- Seasonal and market conditions;
- New research findings;
- Likely profit impact;
- Target groups; and
- Particular regional issues.

Finally, industry research bodies commissioning research (DA, Gardiner etc) could require more consideration of translation and implementation in their funded research. This would include:

- Building in rules of thumb for application;
- Integrating application into work day/week; and
- Outlining impacts of proposed change on:
 - Cash flow;
 - Implementation period;
 - Production (short and long term);
 - Working week/day; and
 - Skill needs.

Kaine and Wright (2016) concluded that adoption will be faster if an innovation is perceived as being simpler and having greater impact, relative to other possible changes.

Nuthall (2009) has noted that farmers do not use automated decision support systems but rely on their own skills and training and it is therefore important to embed practices. Our observations and the background review of intuitive and fast decision-making support this, so it is important that practice and system change can be integrated into day-to-day activities. As noted above, software applications that are simple and can be used with portable devices, are

more likely to be adopted. Similarly, where routine production systems are integrated with performance data, then use of such data will be higher. For example, this may be a co-benefit from robot milking, with easily accessible data being built into the system.

We also think there is a case for integrating exercises in self-reflection into feedbase and other management programs. There would be three parts to this. First, showing that fast thinking is dominant, practical and generally effective but pointing out the limitations and risks. Secondly, would be encouraging people to review their decision-making patterns to build awareness of their tendencies and the influence of 'biases'. Thirdly, would be some reflection on their own objectives and preferences, since the business and farm systems need to be reasonably compatible with what people are comfortable doing.

To conclude, we find there is potential to increase HGF production on many farms. Management of key factors such as fertiliser, grazing, pasture and crops can be developed through the application of general principles and there is a case for identifying and promoting these principles on a broader basis. There is however, a case for regional and local adaptation, given some system diversity.

A key argument from this project is that there are multiple pathways and approaches through which to deliver priority messages. The common theme is engaging farmers so as to support reflection on current practices, relative to industry trends and business objectives. Some respond well to direct challenges, such as the performance of benchmarked farmers, but others need milder forms of encouragement. A key industry role is to prioritise and coordinate the messages communicated to farmers and to promote greater self-reflection by farmers.

The common goal of all the strategies recommended here is to encourage reflective thinking amongst farmers. This may be through the influence of peers, the excitement of new research or from seeing new systems and practices. Such reflection will not always, perhaps even rarely occur to the extent that industry agencies might hope for, but we hope this report has pointed to ways in which response rates might be improved.

APPENDICES

APPENDIX 1: SURVEY QUESTIONS (PRODUCERS)

About the farm and farm business

1. Your farm operation.
 - a. What is your herd size (milking cows) at peak production?
 - b. When are:
 - i. calving and
 - ii. peak production times?
 - c. What is the total farm area (ha)?
 - d. What is the area of the milking platform (ha)?
 - e. What is the area that produces feed but is not grazed by the milking cows (ha)?
 - f. What is your total milk production (kg MS/yr)?
 - g. Who do you supply milk to?
 - h. What breed/s of cows do you milk?
How long for? What prompted the change?
 - i. What portion of the total farm area is irrigated (ha or %)?
 - j. What is your average irrigated water use (total or per ha)?
 - k. What amount and types of water allocations do you use, and how much do you own?
Prompts
Surface water
Groundwater
Drainage water
Permanent high reliability, low reliability, temporary etc.
2. How long have you been managing this/these farms? yrs
 - a. How long have you been in the dairy industry? yrs
 - b. What made you want to be a dairy farmer?
3. Management structure of the farm
 - a. Who is involved in the business?
 - b. In addition to those people already discussed, how many people are employed in the business?
.....
 - c. How many hours do you typically work a week?
 - d. Who makes the major decisions about the business?
 - e. Is it the same for decisions about the feedbase?
 - f. What percentage of your family's income is from the dairy business?
 - g. What financial indicators do you use to see how the business is going?

Prompt examples:
 - *Cash flow*
 - *Cash surpluses*
 - *Gross margins*
 - *Return on investment*
 - *Other**How are these determined?*
prompts e.g use a consultant, accountant, bank, Dairy Monitor, DairyBase etc.
 - h. Do you have a set plan for the business?
 - i. How do you see debt in terms of business and financial management?
4. What are main goals that you have for the farm or the farm business?
5. In terms of farm management what are your priorities? (What do you focus on or do you consider most important in the day-to-day running of the farm?)

Prompt: Where does feedbase management sit in your priorities?
6. Farming satisfaction
 - a. What is your favourite thing to do on the farm?
 - b. What other (3 or 4) aspects of your work that you like or give you the most satisfaction? (in order of importance)
 - c. What are you most proud about in regards to the farm?

Feedbase management

About you and pasture management

7. Can you describe your feed system, including irrigation and dryland (annual) silage and hay production, pasture and crop species, purchasing feed and utilisation of grain and concentrates?

Follow-up prompts

- *Variability of water availability? Impact of water price on your feed system (scale of irrigated pasture/forages/crops cf purchased feed)?*
- *What is the mixture of pasture vs crops?*
- *What type of crops and pastures? Also other forages such as lucerne*
- *How much grain/concentrate/hd?*
- *How much silage is produced on-farm?*
- *Is fodder bought or enough produced on farm?*
- *If you buy in feed is it a set amount each year or does it change?*
- *How do you decide what you grow versus what you buy or contract in?*
- *Persistence of perennial pastures?*
- *Pasture renovation practices*
- *Mixer or feed wagon*
- *Do you use a feed pad? What type of structure is it, e.g. permanent concrete, dirt stand-off area,*
- *When do you use your feedpad? (e.g. every summer, when too wet/dry)*
- *Diet balance tools or software (e.g. Rumin8)?*
- *Feed budgets*
- *How did the system develop?*
 - a. Has the feed system changed much since you started on the farm?
 - b. How do you decide what paddocks to graze and when to graze them?

8. Do you monitor or measure your pasture?

- a. If so, what are the procedures?

Prompts

- *rising plate meter, C-DAX or other quad mounted meters)*
- *Leaf stage/leaf appearance*

How often?

If assessed by eye, how long since you calibrated that with other measures?

9. How do you decide what pasture and crop species to use?

10. Irrigation practices

- a. What type of system do you have (e.g. flood, pivot, pipe and riser, sub surface etc)
- b. What type of technology do you use, soil moisture probes, automation etc?
- c. How do you determine when you irrigate? E.g. set amount of days, use soil moisture monitoring, use ET data etc.
- d. Has your irrigation system changed over the last 10 years and /or are you planning to change in the future?

11. Soils and fertilisers

- a. How often do you have your soils tested?

What are you looking for in the soil test results?

- b. What fertilisers do you use and what are your application rates? How do you determine what and how much you put out?

- *Urea/Nitrogen*
- *NPKS*
- *Phosphorous*
- *Potassium/Potash*
- *Manure*
- *Other _____*
- *Lime*

Feedbase management

12. What are your main goals, in order of importance, in regard to home-grown feed production and utilisation?

13. What is your pasture consumption/utilisation? (tonnes of dry matter/ha

Note: the degree to which they are familiar with this.

- a. *If known, how do you calculate it?*
- b. *To your knowledge, how does your consumption compare with that of other farmers in your area?*

14. Are you confident that you are able to get the most from the production and utilisation of your pastures and crops? If so, how confident

Prompt for overall level of confidence.

- a. *Very confident*
- b. *Confident*
- c. *Not Sure*
- d. *Not very confident*
- e. *Not at all confident*

15. Are there things that you could fairly easily change to improve the **quality or quantity** of your home-grown feed?

16. And any possible changes to improve the **utilisation** of home-grown feed?

17. If money wasn't a problem are there larger, more ambitious changes that you would include that would impact on pasture or feed management?

Prompt for

- a. *New infrastructure (dairy, irrigation, farm layout, drainage)*
- b. *Feed pads, new roads, underpass*
- c. *High flow irrigation*
- d. *New irrigation systems*

18. Considering both easy and challenging changes, what feed consumption target do you think is possible?
.....

19. If you were able to produce more home-grown feed, would you:

- a. *Increase stocking rate?*
- b. *Conserve more feed?*
- c. *Increase milk production per cow*
- d. *A combination?*

20. What circumstances, events or factors would encourage you to make the changes we have discussed?

Prompt to confirm order of importance.

21. How do you think your working life, family life and farm business would change if you were able to make the changes we have discussed?

22. What are your main sources of information and advice in relation to pasture production and utilisation?

Prompt or category list

- a. *Nutritionist*
- b. *Retail agronomist*
- c. *Other consultant/s*
- d. *Independent agronomist*
- e. *Other dairy farmer/s*
- f. *Factory field worker*
- g. *Discussion groups/field days*
- h. *Other programs or extension run by RDPs*
- i. *Government extension services*
- j. *Journals/magazines*
- k. *Focus farms*
- l. *Other on-line sources*

Feedbase management

- m. Own experience
- n. No advice from others

Prompt to confirm most important

- a. Do you participate in discussion or business network groups?
If so, what do you like about them? How useful do you find them?

Summing up prompt: overall rating:

- a) very useful
- b) somewhat useful
- c) neither useful nor not-useful
- d) not very useful
- e) not at all useful
- f) Not useful for me but useful for others

- b. Do you attend field days or other programs?
How do you rate the usefulness of these?

Summing up prompt: overall rating:

- g) very useful
- h) somewhat useful
- i) neither useful nor not-useful
- j) not very useful
- k) not at all useful
- l) Not useful for me but useful for others

- 23. When you need information about your home-grown feed, what is your preferred method of receiving this information?

Prompt for most important.

- 24. What courses, such as those run by Murray Dairy or DEDJTR have you participated in and were they useful? In what ways

Prompts

Target 10

Feeding pastures for profit

Cups on Cups off

- 25. Have you been involved in any research activities before?

- a. Never
- b. Rarely
- c. Occasionally
- d. Often
- e. Used to but less so now

- 26. In relation to your farm and farm business, what are the learning priorities for you? (What would you like to learn more about?)

Prompt for order of importance.

About you and the industry

- 27. How are you feeling about the future of the dairy industry?

Prompt: So overall you are very/fairly positive/negative

Prompt: Note the issues that are prominent (eg prices, costs, water for irrigation)

- a. Has your view of the industry changed over the last few years?
- b. Thinking about what we have discussed today, if we had come here 12 months ago do you think you would have given some different answers to any of the questions?
- c. Do you think you will still be dairy farming in 5 years' time?

- 28. Considering the whole farm or the farm business, what areas do you think need more research, especially to influence outcomes in the next 5 to 10 years?

Feedbase management

29. Are there any other points you would like to make about the production and utilisation of home-grown feed?

Optional Questions

- Are there any other extension activities or courses that you would like to see put in place that would make it easier for you to farm?
- What personality traits do you think make a better farmer?
- If your cows could talk would do you think they would say about you?
- What challenges you as a dairy farmer?
- What do you want people to know about being a dairy farmer?

About your experience in the dairy industry

1. Could you tell me about the nature and extent of your work with dairy farmers?
2. How long have you worked in the dairy industry?
How long have you been providing advice or support for dairy farmers?
1. How have you developed your expertise and sources of information about dairy systems?
What do you use to get recent information or ideas?
2. Do you think there are identifiable or common types of dairy farmers, considering personal and business priorities, ways of thinking and work and lifestyle preferences?
What types of farmers mostly seek your advice

Dairy farmers and feed systems

3. From your experience and observation, are there identifiable types of feed systems, or predominant practices that you recommend in regards to pastures, crops, grain and concentrates?

Prompts

- *Pasture and crop species?*
 - *Pasture renovation practices*
 - *Amount of grain/concentrate to feed?*
 - *Annual crops for grazing or harvesting for feed*
 - *Use of mixers or feed wagon and/or feed pads?*
 - *Diet balance tools or software (e.g. Rumin8)*
 - *Use of feed budgets*
 - *Stocking rates*
 - *Grazing management*
 - *Pasture pest management*
4. Are there particular water use and management systems for pasture production in this region?
 5. Have you noticed any major changes in feed systems or practices in the time you have been working with dairy farmers in this region?
 6. What are the main factors that influence farmers' selection of pasture and crop types?
 7. What most influences decisions on how much and what type of feed to buy in and how much grain or concentrate to use?
 8. What are the main ways that farmers assess and make decisions about the utilisation of their established pastures?

Prompts

- *When to graze them?*
 - *When to cut?*
 - *Pasture monitoring*
 - *Pasture measurement*
 - *rising plate meter, C-DAX or other quad mounted meters)*
 - *Leaf stage/leaf appearance*
 - *Other*
9. What do you think is the skill or accuracy level of visual assessment of pastures by farmers?
 10. In general, how do farmers estimate pasture production/consumption/utilisation? How accurate do you think those estimates are?
 11. What are the average and range of pasture production/consumption/utilisation for different types of country in this region? (..... tonnes of dry matter/ha)?
 12. Do you think there is capacity to increase pasture production/consumption/utilisation in this region?
If so, for what types of farms or farm businesses, do you think there is the most scope to increase consumption/utilisation?
 13. What are the key things that could be reasonably easily changed to improve the **quality, quantity and utilisation** of home-grown feed on farms
What types of farms could these changes occur on?
 14. Are there larger or more innovative changes that could be made to management practices that could lead to a major and on-going increase in feedbase production throughout the region?
 15. Considering both the smaller and larger or more innovative changes, what production and consumption targets do you think are possible?
 16. If there were to be an increase in the quantity, quality or utilisation of home-grown feed, what would be your recommendations in regards to the additional feed:
An increase milk production per head?
An increase stocking rate?
Some combination of these two

Feedbase management

Same production and stocking rate but more feed security?

17. What would be the impact on farm profitability?
18. What are things that can encourage farmers to make the types of changes we have discussed?
Prompt: Also confirm impediments to change
19. From your experience what are the main sources of information and advice in relation to pasture production and utilisation that the farmers you have contact with, most rely on?
Prompt or category list
 - Nutritionists*
 - Retail agronomists*
 - Independent agronomists*
 - Other dairy farmers*
 - Factory field workers*
 - Discussion groups/field days*
 - Other programs or extension run by RDPs*
 - Government extension services*
 - Journals/magazines*
 - Other on-line sources*
 - Own experience**Prompt to confirm most important*

In your opinion are these useful or reliable sources of information?
20. In your opinion what industry extension programs have made significant and positive differences to the management of home-grown feed?
What was it about it/them that made it/them effective?
21. Are there programs or strategies that you can envisage that could help dairy farmers make positive and significant changes to home grown feed production and utilisation?
What content would help the most?
In your experience, what is the most effective means of engaging with and influencing farmers?
22. From your experience, do you find some farmers don't sustain on-going improvements in pasture production quantity, quality or consumption?
What are the characteristics or factors important in sustaining the improvements?
Why do some farmers not sustain the improvements?
23. What do you think should be key industry research priorities in relation to pasture production, utilisation and pasture management?
24. Are there any other points you would like to make about the production and utilisation of home-grown feed?

APPENDIX 3: PERSPECTIVES ON DECISION-MAKING

Perhaps the most influential 'model' of decision-making has been that of *the rational person*, able to identify and evaluate evidence for and against a range of choices and select the one that maximises the overall utility of choices for the individual, family or business unit. There are three traits to the ideal (hypothetically complete) model of rationality.

- The *intuitive scientist* within us searches for and considers new data, identifies causal relationships and updates responses and choices accordingly (Tetlock 2002). For example, once the characteristics and performance information of ryegrass varieties were known, then the 'scientific' dairy farmer would select the best performers for their circumstances.
- The *intuitive statistician* understands risk and probabilities and is therefore able to choose options that accord with these. For example, the statistically minded dairy farmer could evaluate the likelihood of success and risks of buying an additional farm, considering the milk price range, climatic variation and so on.
- The *intuitive economist* is able to evaluate and compare investment options, such as the new dairy versus a new irrigation system.

Much research and extension material, prepared by professional scientists, statisticians and economists, is implicitly based on each of these models, yet the assumption that these capacities would generally be evident in the untrained have been challenged on a number of grounds.

- Our goals, which need to be known to apply rational analysis on how to achieve them, can be numerous, changeable and not always clear, even to ourselves.
- It is time consuming and near impossible, especially in high-information environments, to gather and process all relevant information to make choices.
- Future outcomes can be highly uncertain, especially in complex environments and so assessing the eventual benefits of a choice is not just about the evidence to hand.

These challenges led to the concept of *bounded rationality*, whereby information and processing limits are recognised and in making choices, we are assumed to be considering only some reasonably easily accessible information, our priority goals and a limited range of options (Gigerenzer and Goldstein 1996). We may engage in more extensive searching (for information and ideas) if the problem or opportunity is unusual or new to us.

In the last 20 years however, there have been much greater challenges to the rational models of decision-making, especially through the work of Daniel Kahneman and Amos Tversky. Kahneman has summed up their work, and his related subsequent solo work and work with others, in the book, *Thinking Fast and Slow* (Kahneman 2011). Kahneman concludes that we have two modes of thinking. 'Fast' thinking, or System 1, is rapid, intuitive and characterised by the use of heuristics, or cognitive short-cuts (Buturovic and Tasic 2015, 129). For example, the 2-3 leaf stage assessment of pastures for grazing is a useful heuristic in deciding on the next paddock to use, rather than doing some more technical assessment of total biomass. 'Slow' thinking, or System 2, is reflective, analytical and 'effortful' (Buturovic and Tasic 2015, 129), more like that of the rational person model, with the deliberate collecting and analysing information. A cost-benefit analysis of a proposed new dairy or the purchase of an adjoining property would engage System 2, as information was gathered and formally analysed.

Fast thinking is highly functional and is essential in a complex and dynamic world. Too much System 2 thinking would lead to decision-making paralysis and it is important to note that slow thinking is also physically and mentally taxing. It is therefore understandable that fast thinking is our overwhelming mode. Problems can however arise from the overwhelming use of fast thinking, as this enables a range of cognitive tendencies that lead us to overlook or downplay important information. This may mean that '... what our attention is drawn to, what we focus on and what we recall is not always what is most necessary or needed for optimal decision making' (Shleifer 2012, 1089). There are a number of tendencies, as set out in Table 5, which together can lead us to miss important information and resist ideas and information we find uncomfortable.

Many of these cognitive inclinations are referred to as biases, but this is meant in the sense of being divergent from an ideal model of thinking based on a capacity for technically rational thinking. Bias has however, a more common and critical meaning so we prefer to describe these in general discussion as tendencies. In summary, these are tendencies that influence what information we consider, how we respond to that information, how we think about ourselves and our experiences, how we tend to resist ideas and arguments against the beliefs we hold and how we are influenced by the appearances, roles, status and relationships of others.

In relation to the latter point, and in addition to the research in cognitive psychology, social identity theory may also be relevant. The assumptions from this theory are that we tend to: categorise people, using social indicators as heuristics; identify with a particular group or groups; and compare our group with others. This could be especially relevant to dairy extension work where the 'dairy identity' and then particular regional and

Feedbase management

local identities seem to be very strong. These identities will then be important in who is considered an acceptable or knowledgeable source of information. Further to that, people are influenced by the position, experience, manner and appearance of presenters. Therefore, the selection of who delivers key messages is an important and multi-factorial decision, with content knowledge being only one consideration. Repetition of key messages is also likely to be influential, especially when combined with memorable phrasing.

On the other hand, there are cognitive tendencies that can make changing attitudes and practices difficult. Fast thinking and heuristics can lead us quickly to decisions and positions that we are then reluctant to abandon, especially where current practices are reinforced by family, peers, recollections of our own experiences and level of comfort with those practices. When confronted with a challenge to the way we are doing things, we have first responses to prefer evidence supporting what we do already, we think of arguments against the challenge and we might make only very small concessions to new information, especially if this involves strongly held beliefs.

Table 5: Selected cognitive tendencies and their effects

Tendency	Effect
<i>Evaluating information:</i> <ul style="list-style-type: none"> • Affect heuristic • Availability heuristic • Anchoring • Focussing effect • Illusory correlation • Regressive tendency • Clustering illusion • Optimism preference 	<i>Effect of:</i> Influence of emotional responses on decision-making (how we feel about something as opposed to what we think about it) (Kahneman 2011, 39). Stronger influence of recent events and discussion of recent events; easily accessible and/or processed information; and vivid or memorable events. Relying on a base point to evaluate information, rather than comparing things equally. Focussing on one particular aspect of an issue, rather than other aspects that may also be important. False correlations between events or trends. Downplaying high and low probabilities (regressing to the 'mean'). Overestimating the effect of small patterns/clusters. Focusing on favourable outcomes.
<i>Financial decision-making</i> <ul style="list-style-type: none"> • Loss aversion • Hyperbolic discounting • Sunk cost fallacy • Declining utility of wealth 	<i>Effect of:</i> Weighting losses more than gains; an inclination to protect nest eggs. Allocating high value to immediate income. Continuing with a course based on previous investment. The value of wealth declines with increasing wealth (motivation to accumulate may decline).
<i>Resistance to new ideas:</i> <ul style="list-style-type: none"> • Confirmation bias • Desirability bias • Status quo preference • (Limited) belief revision 	<i>Effect of:</i> A tendency to search for evidence to support current views. Preferring 'good news' over bad news (Tappin, McKay, and van der Leer 2017). A preference for current state or situation. Only making small concession to even strong contrary evidence.
<i>Memory & hindsight:</i> <ul style="list-style-type: none"> • Choice supportive effect • Outcome orientation • Rosy retrospection • Hindsight bias • Consistency effect • Self-serving bias 	<i>Effect of:</i> Favourable recollection of one's own past choices (Mather, Shafir, and Johnson 2000). Judgement based on later outcomes rather than the context at time. Favourable memories of the past. Seeing past events as more predictable than they were. Aligning past beliefs & ideas with present ones. Favourable view of self in past actions.
<i>Communication & cognition:</i> <ul style="list-style-type: none"> • Framing effects • Halo effect • Authority effect • Reactive devaluation • Spacing effect • Illusion of truth • False consensus 	<i>Effect of:</i> Acceptance of argument or evidence varying with how they are framed Response is to personal characteristics of presenter or source Response is to perceptions of position or expertise Response is based on dislike or distrust of source of information Idea becomes familiar over a longer period Belief develops through familiarity with the concept, slogan or phrase Overestimating others' agreement with your attitudes and beliefs

Another key implication of this model of cognition for extension programs, is that there is a potential mismatch between on-farm decision-making and the way research is conducted and reported. On-farm decision-making will be dominated by fast thinking, especially given the cognitively intense environment of dairy farming with

Feedbase management

the need for rapid and multiple decisions about grazing rotations, herd health, whether to grow or buy feed, likely seasonal outcomes and so on. Conversely, conventional research is more aligned with slow thinking, with the deliberate collection, assembly and consideration of data. Eastwood and Kenny (2009) have observed the differences between dairy farmers 'heuristics' decision-making and, what they term 'data-driven' approaches to management that arise from research.

While this report is influenced by the 'two systems' thinking, there are some important qualifications to note. The two systems concept is a metaphor and a heuristic to illustrate tendencies rather than the identification of actual physical systems. Hence, particular cognitive episodes should not be categorised according to this conceptual framework. Secondly, the two systems are obviously and heavily integrated. Learning from the application of System 2, feeds into the background knowledge of System 1 functionality. System 1 is a learning system, with experiences, observations and ideas contributing to a data stock, though a warning on the unreliability of memory applies. Hence, training and systems that embed research-informed practice feed into the fast thinking. In addition, things that encourage reflection, such as expert opinion, and the challenge of what other farmers do and think are very important means of triggering such reflection.

While this focus on 'behavioural' tendencies is important in refining research and especially extension, conventional analyses also remain important. Measures of **economic profit** and **return on asset/capital** are effectively forecasting whether or not a system is financially sustainable over a longer term. Similarly, cost-benefit analyses of options or innovations give an indication of relative potential and help to identify the most important and sensitive variables. In addition, these types of analyses can have important cognitive and social functions. They provide a comparison (anchor point) and reinforce the self-perception of farmers as economically 'rational', or at least as economically aware.

Furthermore, the concept of **specialisation** from conventional economics is also important. Where people within the business are able to specialise, this is efficient in a conventional sense, but it also helps in building skills that become 'intuitive;' through repetition and in sharing the cognitive load. That is, if someone is able to focus on the dairy and someone on the feed, and someone else on the irrigation then each is able to devote more time to particular aspects of work and practices and processes can be more easily embedded into the fast thinking.

APPENDIX 4: ATTITUDES TO THE FUTURE OF THE INDUSTRY

Respondents were asked about how they saw the future of the industry. As noted in the body of the report, attitudes were probably affected by particular events or circumstances, such as the previous dry summer, the wet winter and pricing decisions by processors. We noted some increasingly positive views over the course of the interviews, as the wet winter receded, water stocks increased and there appeared to be improved prospects for milk prices.

On industry prices and processors, themes included:

- Murray Goulburn management decisions and responses.
- Other processors 'taking the opportunity' to lower prices.
- Concern about risks to MG viability. The loss of a major player would further destabilise the market.
- Dilemmas about changing suppliers: Loyalty as against looking for better prices.
- Concern about other farmers changing suppliers and therefore losing collection services.

On their own future in the industry, the main positions included:

- 'It's a great industry'. This was the majority of the respondents. Most especially younger ones, accept the market volatility of deregulation, though there are others that think back with some longing to the regulated era.
- 'Its been good, but I have some concerns about the future'. Such concerns more often relate to the future of the industry in general, rather than the personal situation.
- 'I am rethinking the situation'. Factors here include age and career stage, debt level and market and seasonal conditions.
- 'We are done'. These were a minority but are not necessarily restricted to people in financial difficulty and it may rather be the low return for effort, volatility and risks.

Experienced farmers from the first two response groups are often interested in mentoring and facilitating the development of younger farmers (see Appendix 7).

Respondents were also asked about how they saw the future of the industry in terms of farm scale and structural adjustment. Most expect fewer businesses, though not necessarily a decrease in milk production. At one end of the opinion spectrum are those who see as inevitable and a few cases even desirable in making for an efficient industry. There is no strong view that the future is in corporate farms. Both corporate farm managers and other farmers noted negative attitudes to corporate farms.

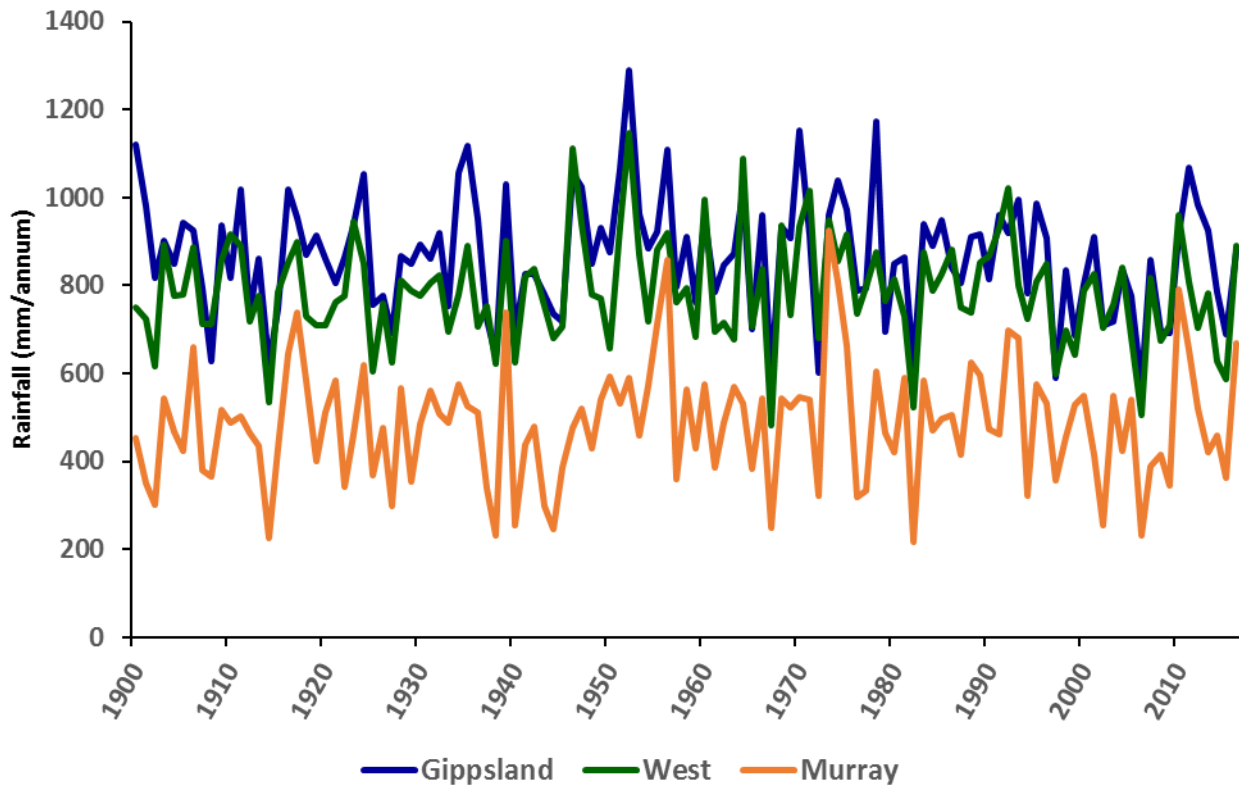
With people leaving the industry, some especially felt the loss of the dairy identity of the region and changes in 'dairy towns'. This was especially so in regions where particular dairy farms have become more 'isolated' as land is turned to other purposes. Of special concern in the Murray region was the 'loss' of water to other industries. Changes in land use, for example from dairy to beef cattle, are reminders of structural change and people especially note where land appears to be, in their terms, abandoned.

Views on the prospects for entrants into the dairy industry also varied, including somewhat by region. There is a more positive view in Gippsland. For some, it was still seen as possible to work up through share-farming and leasing, though there are different views on whether or not it would be possible or desirable to buy land. At the other end of thinking, many saw the capital costs as too high.

APPENDIX 5: CLIMATE TRENDS IN THE STUDY REGIONS

Climate data for each of the farms where people participated in the survey, were drawn from SILO, based on the nearest data collection points. This was then aggregated and averaged by region for some analyses, while other conclusions were drawn from studying impacts on a range of farms.

Figure 2: Annual average rainfall for Gippsland, Western and Murray dairy regions of Victoria, averaged from ~50 farms in each region from 1900 to 2016



Since around 1980 the tall peaks of rainfall have reduced in Gippsland and Western Victoria. While there have been years of high rainfall in the last few years corresponding with La Nina events, these peaks were actually not as high as the rainfall received in past La Nina cycles over the last century

Feedbase management

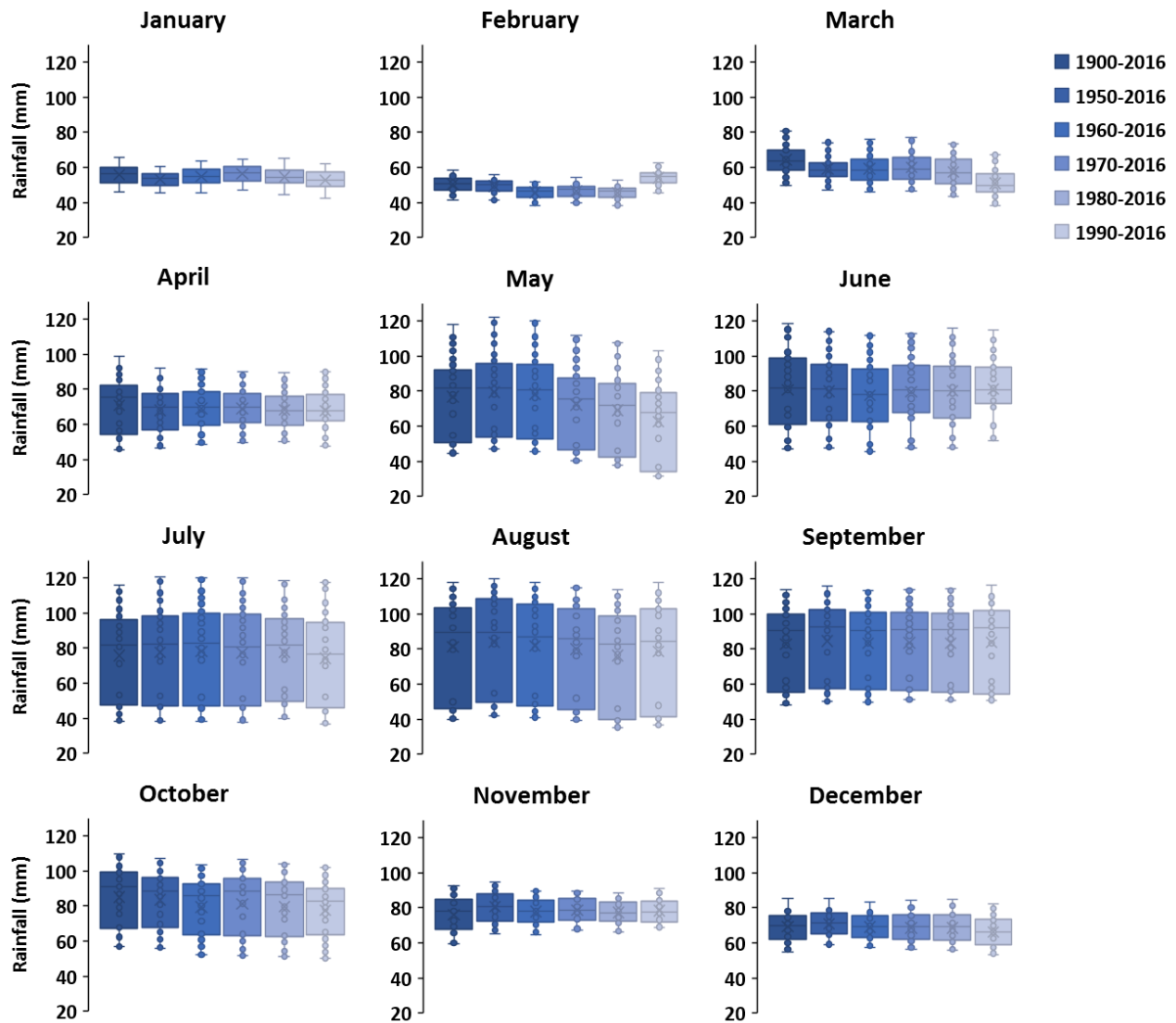
Figure 3: Variations in long-term annual average rainfall for dairy farms in each of the Gippsland (52 farms), Western (51 farms) and Murray (50 farms) dairy regions of Victoria.



- As expected, rainfall has decreased in recent decades
- There is greater variation in annual rainfall in Gippsland since 1990 than other regions
- There is less variation in annual rainfall in the North since 1990 (this doesn't quite match with what we have been told, needs looking at further)
- Of the farms studied, Gippsland had the greatest reduction in annual average rainfall (-5%), followed by Western Victoria (-3%) then the North (-1%) when comparing 1990-2016 with 1900-2016 rainfall.

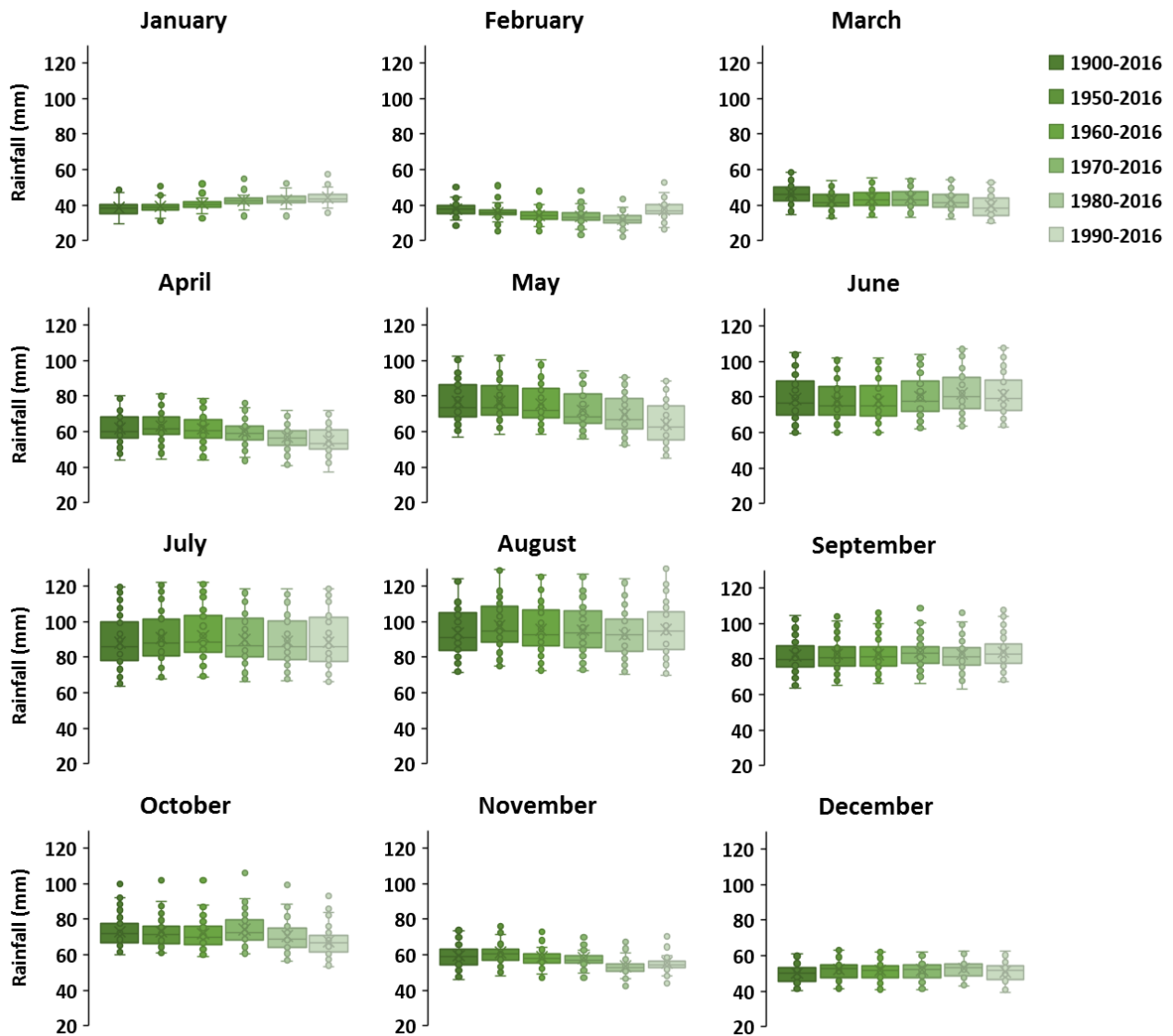
Feedbase management

Figure 4: Variations in long-term average monthly rainfall for 52 farms in the Gippsland dairy region of Victoria



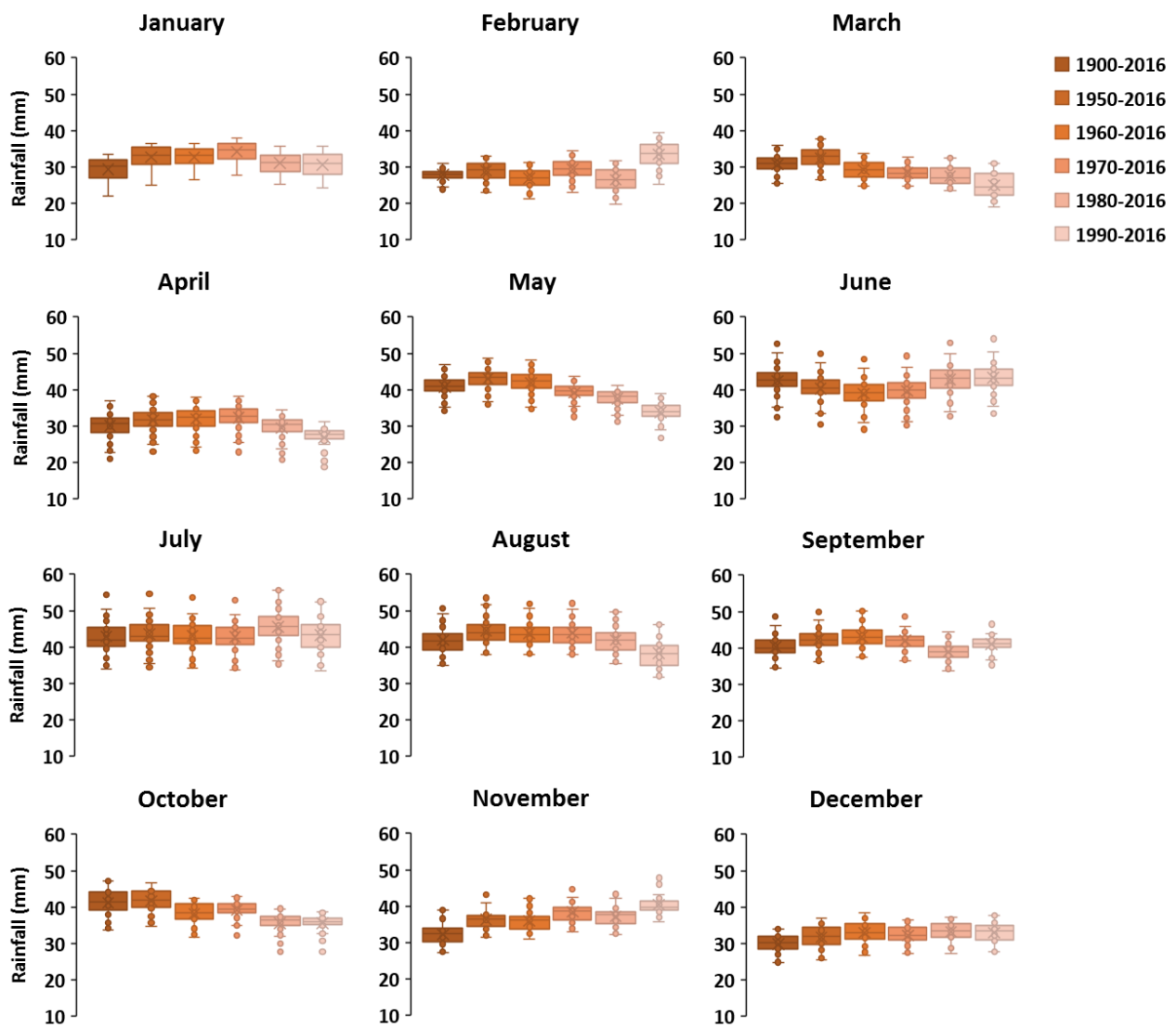
Feedbase management

Figure 5: Variations in long-term average monthly rainfall for 51 farms in the Western dairy region of Victoria



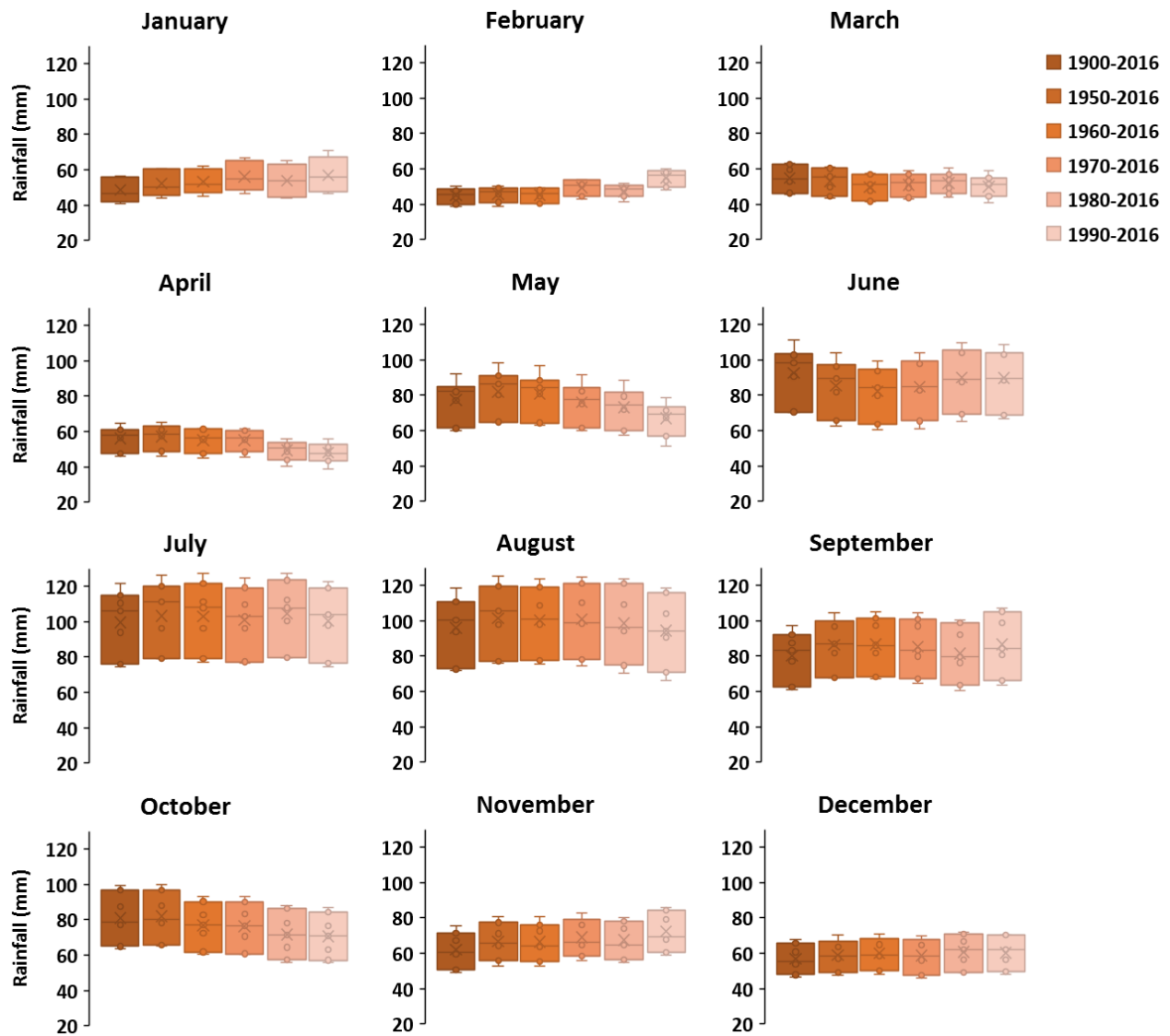
Feedbase management

Figure 6: Variations in long-term average monthly rainfall for 42 farms in the Murray dairy region of Victoria (excluding north east Victoria)



Feedbase management

Figure 7: Variations in long-term average monthly rainfall for 7 farms in north east Victoria in the Murray dairy region



Feedbase management

Table 6: Variations in monthly rainfall patterns when comparing 1990-2016 to 1900-2016 long term average rainfall

Rainfall effect	Gippsland			Western Victoria			Murray		
	Month	Average (%)	Lower and upper ranges (%)	Month	Average (%)	Lower and upper ranges (%)	Month	Average (%)	Lower and upper ranges (%)
Increased rainfall around summer time	February	7	-4 19	January	16	6 33	November	24	12 37
							December	10	1 19
							January	6	-4 25
							February	20	5 31
Decreased rainfall in some shoulder season months	January	-6	-13 2	March	-15	-29 -2	March	-17	-28 -2
	March	-21	-30 -13	April	-11	-20 -5	April	-11	-20 -4
	May	-21	-33 -11	May	-17	-28 -10	May	-16	-25 -5
Similar monthly rainfall	April	-3	-15 17	February	-1	-12 7	June	1	-9 5
	June	3	-9 23	June	3	-1 10	July	1	-6 7
	July	-3	-12 5	July	0	-4 7	September	3	-6 16
	August	-5	-16 4	August	2	-9 9			
	September	1	-5 6	September	2	-6 13			
	November	4	-8 19	December	2	-11 8			
	December	-4	-13 4						
Decreased rainfall in peak growing time (Aug to Nov)	October	-9	-16 -2	October	-8	-16 -1	August	-8	-14 5
				November	-6	-13 11	October	-13	-19 -8

- The north had a significant increase in rainfall over four months at summer time, particularly in November and February
- Gippsland and Western Victoria each had one month of increased rainfall in summer
- All regions had substantially less rainfall in autumn months which is likely to impact on the start of the growing season
- While Gippsland had the greatest percentage decrease in annual rainfall (-5%), it had the least variation in seasonal rainfall variation, followed by Western Victoria, while the Murray region had the most variation in seasonal rainfall
- Decreased rainfall in peak growing times may be of less importance than at other times of the year due to possible excesses of feed

Pasture growth restrictions

Perennial ryegrass is effected above 22 degrees Celsius. Table 3 shows a comparison of the last 17 years with long term temperature records in the dairy regions of Victoria. The number of days within a temperature range were calculated for each farm and then averaged to derive the data below.

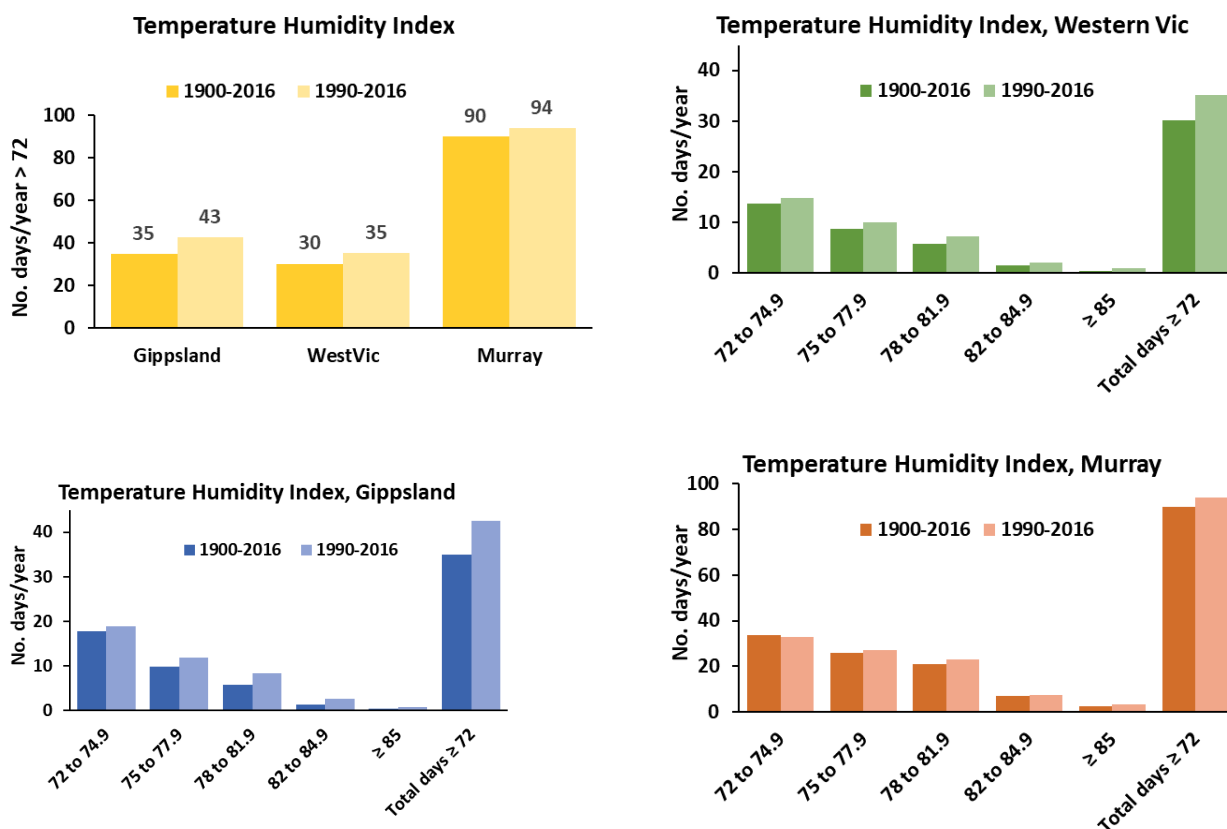
Table 7: Average number of days per year within a specified temperature range

	Gippsland		WestVic		Murray	
	1900- 2016	1990- 2016	1900- 2016	1990- 2016	1900- 2016	1990- 2016
20-24.9 C	88	86	72	72	73	73
25-29.9 C	39	41	29	31	67	66
30-34.9 C	13	16	13	15	43	46
35-39.9 C	3	5	4	6	16	18
≥ 40 C	0.3	0.6	0.5	0.9	3	4
No days > 30 C	16	22	17	21	62	68
Diff in days > 30 C recently	6		4		6	
No days > 35 C	3	6	4	7	19	22
Diff in days > 35 C recently	3		2		3	
No days > 40 C	0	1	0	1	3	4
Diff in days > 40 C recently	0		0		1	

Cow Health

Temperature Humidity Index (THI) is a robust predictor of heat stress in cows (Nidumolu *et al.* 2014). A THI below 70 is considered comfortable for dairy cows. Once THI exceeds 72, reproductive performance is effected with decreased conception rates. Milk production is seriously affected when THI exceeds 78, and once above 82, cows have significant losses in milk production, severe heat stress and risk of death. A THI of 78 will occur at 27°C and 80% relative humidity or 31°C and 40 percent relative humidity [Cool Cows website, DA].

Figure 8: Variations in the Temperature Humidity Index (THI) for dairy farms in each of the Gippsland (52 farms), Western Victoria (51 farms) and Murray (50 farms) dairy regions of Victoria.



APPENDIX 6: DAFS INDUSTRY SEGMENTS AND IMPLICATIONS FOR INFLUENCE

Source	Categories	Effects	Targeting
DAFS industry segments	<i>Winding down</i>	Highly risk averse; No growth strategy; Least likely to innovate; low use of consultants	No incentive for innovation; Very difficult to influence
	<i>Family first</i>	Risk averse; Self-reliant; Low levels of adoption; May consider changes to benefit next generation/s; low use of consultants	Selective engagement with industry programs
	<i>Established & stable</i>	Risk averse; Self-reliant; low use of consultants	Limited engagement with industry programs
	<i>Love farming</i>	Positive about industry; open to risk; bonding capital; low use of consultants; participate in discussion groups or similar; growth or open to growth	Open to incremental change; interested in 'practical' applications;
	<i>Open to change</i>	Business growth; use of consultants; range of information sources	Potential early adopters
	<i>Growing for the kids</i>	Business growth; use of consultants; planned changes	Interested in R&D outcomes

Source: Waters *et al.* 2009

APPENDIX 7: NEW ENTRANTS TO THE DAIRY INDUSTRY

We interviewed a number of early career dairy farmers and also asked all respondents about how they saw the future of the dairy industry, which sometimes included discussion of the prospects for people entering the industry.

There were differences amongst the experienced farmers in regard to the prospects for new entrants. Some, especially from Gippsland, are still optimistic and see that people could start out share-farming and leasing and build assets from there. On the other hand, there were more responses expressing concern about the prospects for young people. Some themes were:

- The capital required to enter the industry. This was commonly cited.
- Observations that dairy farming would not appeal to the 'younger generation' due to changed attitudes to work, lifestyle and expectations of immediate income.
- Vulnerability when starting out, due to exposure to seasonal and market conditions. There were many anecdotes about potentially 'good farmers' who were adversely affected by the price downturn.

From those new entrants that we interviewed, we saw, somewhat contrary to the general comments about the 'younger generation' as above, people who have taken considerable financial risks to enter the industry and are indeed working very hard. In addition, early career dairy farmers without the family farm pathway may have additional insecurity related to leases and share-farming. Changes in the circumstances of the landholder or their families, or disagreements over conditions of the lease or share farming, can result in a need to start again. It is recommended that industry run, or continue to run, programs to support financial management specifically for getting started; and to support and if necessary facilitate mentoring activities. Programs such as *Taking Stock* may be particularly important for this group. The *Focus Farm* program also includes many important elements that will support early career farmers, with mentoring, peer learning and paddock learning. We note however, the cost of rolling this program out more generally. There could be further investigation of running a streamlined version of Focus Farms or perhaps mentoring a group of farm businesses.

It may however be difficult to engage with early career dairy farmers. They often have young families, which reduces available time from within the family unit, and cannot afford paid labour. That means, they will have little time for career and skill development, which means programs need to be brief and offered locally or on-line.

APPENDIX 8: CAREER TRANSITIONS AND SUCCESSION

While this was not necessarily an area of frequent concern, we heard about some very significant problems that arise from generational succession and transition out of the industry. Some cases appear to have adversely affected business development and personal relationships.

Key issues were:

- Funding for transition out of the business for the older generation;
- Equity in transition where there are non-farm family members;
- How to manage a staged withdrawal of one generation, enabling involvement but not control; and
- Different or changing goals or approaches within the one generation, eg amongst siblings.

We support the application of programs to support succession planning and note that consultants can have a very important role in these.

Risk preferences are likely to be an important point of differences when different generations work together, and the reasons behind this might not always be appreciated by those involved. There are three elements that could be better appreciated.

- The older generation has accumulated more and we know that people are inclined to heavily favour strategies that protect assets, as against new investments. Conversely, younger generations, who have less to lose, may be more risk accepting.
- Experiences affect risk preferences and age will bring with it exposure to many more memorable events, such as price crashes, droughts, floods and so on, all of which can have lasting effects. This will then affect risk preferences.
- Different generations have differing time horizons, say 10 years of business work left versus 30 years, and so there will be different views on capital investments.

It may be useful to introduce more cognitive explanations of generational differences in programs to support succession.

Feedbase management

APPENDIX 9: FARMER PERSONAL LEARNING AND INDUSTRY RESEARCH PRIORITIES

Personal learning priorities (in the short to medium term) identified by survey respondents from this study

- Identifying best feed options by persistence, ability to fill gaps, water use efficiency and other factors*
- Crop production, management and rotations
- Increasing overall feed production/consumption
- Irrigation efficiency and systems
- Learning from pasture and crop trials
- Pest management
- Cow health, nutrition and links to profit*
- Genetics, fertility and reproduction
- Using new technologies in herd and grazing management
- Diet balancing and feed budgeting
- Animal handling
- Business and financial management and succession planning*
- Understanding costs of production for feed options
- Benchmarking
- Understanding the global context
- Strategies for managing water markets
- Machinery and equipment maintenance
- Soil health
- Biological/organic farming practices
- Staff management and development and OH&S*
- Farm chemical management
- Managing climate variability and change
- Alternative energy systems
- New labour-saving technologies

Research priorities identified by survey respondents from this study

Pasture

- Variety performance, drought tolerance, persistence, variations by year
- Pasture recovery and optimum shut-down and start-up times
- GMO potential
- Alternatives to ryegrass (including considering climate change)
- Digestibility and impact on condition
- Pest management

Soil condition and fertiliser needs and soil testing

Irrigation management

- tailored to region
- Irrigation efficiency (distribution and crop and pasture uptake)

Stock water quality and management

Drainage management

Pasture and crop combinations

- Performance and optimal combinations of pastures and crops
- Comparative water use efficiencies
- Impacts of irrigation on different species and varieties

Pasture and crop pest management

Feed management through climate variability

Grazing management

Waste management

Herd management

- Cow genetics and optimum size/types
- Fertility
- Animal management and impacts on performance
- Feed management across the year
- Overcoming antibiotic resistance

Feedbase management

Biological farming practices

- Natural animal health
- Alternative fertilisers and composting

Labour management

The industry

- Understanding the dairy products supply chain
- Encouraging people into the industry
- Industry image and welfare issues
- Developing new products and markets

Business management

- Understanding farm business management
- Tools to support financial analysis and decision-making and link to databases
- Risk management
- The economics of different feed combinations and strategies
- Profitability of particular practices (once-a-day milking; cut and carry; barn feeding)

Technologies

- e-Collars
- Remote monitoring (drones, satellite data, etc)
- Virtual fencing
- Automated milking systems

Succession

Research systems

- Keeping research farms relevant to farmer needs
- Research to match farm scales and types
- Engaging farmers to encourage best practice
- Trials in farm settings
- Evidence of product efficacy
- Getting information from other countries
- Making the new system work

Themes identified from the Feedbase Challenge workshops (Kenny and Drysdale nd)

- Summer Feeding of cows
- Irrigation management
- Persistence of perennial ryegrass
- Selecting the most profitable feeding system
- Analysing the drivers for profitable dairying
- Pasture Renovation and species selection
- Alternative pasture species for dryland management
- Impacts of farming systems change explored through business analysis and modelling
- Nitrogen and Gibberellic acid use
- Wet Soil management
- Spring pasture management

REFERENCES

- Armstrong DP, Tarrant KA, Ho CKM, Malcolm LR, Wales WJ (2010) Evaluating development options for a rain-fed dairy farm in Gippsland. *Animal Production Science* **50**, 363–370. doi:10.1071/AN10009.
- Bawden R (1990) Of agricultural systems and systems agriculture: systems methodologies in agricultural education. 'Syst. theory Appl. to Agric. food Chain. Elsevier, London.' (Eds J Jones, P Street)(London, UK)
- Buturovic, Zeljka, and Slavisa Tasic. 2015. "Kahneman's Failed Revolution Against Economic Orthodoxy." *Critical Review* 27 (2):127-145.
- Chapman DF, Kenny SN, Beca D, Johnson IR (2008) Pasture and forage crop systems for non-irrigated dairy farms in southern Australia. 2. Inter-annual variation in forage supply, and business risk. *Agricultural Systems* **97**, 126–138. doi:10.1016/j.agry.2008.02.002.
- Chapman, CF, SN Kenny, and N Lane. 2011. "Pasture and forage crop systems for non-irrigated dairy farms in southern Australia. 3. Estimated economic value of additional home-grown feed." *Agricultural Systems* 104 (8):589-599.
- Crawford, Anne, and Ruth Nettle. 2014. Insights to Change – An evaluation of the strategy to build advisory capacity in Dairy Australia's The People in Dairy program: Final Report. Melbourne: Rural Innovation Research Group, Department of Agriculture and Food Systems, University of Melbourne.
- Darnhofer I, Bellon S, Dedieu B, Milestad R (2009) Adaptiveness to enhance the sustainability of farming systems. *Sustainable Agriculture* **2**, 45–58. doi:10.1007/978-94-007-0394-0_4.
- Davis-Brown K, Salamon S (1987) Farm Families in Crisis: An Application of Stress Theory to Farm Family Research. *Family Relations* **36**, 368–373. doi:10.2307/584485.
- DEDJTR (2015) Dairy Farm Monitor Project Victoria 2014/15.
- DEDJTR (2016) Dairy Farm Monitor Report Victoria 2015-16.
- DPI (2011) Dairy Industry Farm Monitor Project. The influence of farm size on income, costs and profitability: from the Dairy Industry Farm Monitor Project 2006-07 to 2010-11. (Melbourne, Australia)
- Eastwood C, Kenny S (2009) Art or science? Heuristic versus data driven grazing management on dairy farms. *Extension Farming Systems Journal* **5**, 95–102.
- Esqueda MK, Yen AL, Rochfort S, Guthridge KM, Powell KS, Edwards J, Spangenberg GC (2017) A Review of Perennial Ryegrass Endophytes and Their Potential Use in the Management of African Black Beetle in Perennial Grazing Systems in Australia. *Frontiers in Plant Science* **8**, 1–21. doi:10.3389/fpls.2017.00003.
- Fulkerson WJ, Doyle P (2001) 'The Australian dairy industry.' (Victorian Department of Natural Resources and Environment: Kyabram, VIC)
- Fulkerson WJ, Neal JS, Clark CF, Horadagoda A, Nandra KS, Barchia I (2007) Nutritive value of forage species grown in the warm temperate climate of Australia for dairy cows: Grasses and legumes. *Livestock Science* **107**, 253–264. doi:10.1016/j.livsci.2006.09.029.
- García SC, Fulkerson WJ (2005) Opportunities for future Australian dairy systems: A review. *Australian Journal of Experimental Agriculture* **45**, 1041–1055. doi:10.1071/EA04143.
- Gibb I, March K (2015) How do some farm managers always seem to make the right decision? *Australasian Agribusiness Perspectives* **105**, 1–8. <http://www.agrifood.info/perspectives/2015/Gibb.pdf>.
- Gigerenzer, Gerd, and Daniel G Goldstein. 1996. "Reasoning the Fast and Frugal: Models of Bounded Rationality." *Psychological Review* 103 (4):650-669.
- Gottfredson M, Aspinall K (2005) Innovation versus complexity: What is too much of a good thing? *Harvard Business Review* **83**, 62–72.
- Heard JW, Leddin CM, Armstrong DP, Ho CKM, Tarrant KA, Malcolm B, Wales WJ (2012) The impact of system changes to a dairy farm in south-west Victoria: Risk and increasing profitability. *Animal Production Science* **52**, 557–565. doi:10.1071/AN11291.
- Hill J, Chapman DF, Tharmaraj J, Jacobs JL, Cullen BR (2014) Increasing home-grown forage consumption and profit in non-irrigated dairy systems. 3. Intake, milk production and composition, bodyweight and body condition score. *Animal Production Science* **54**, 247–255. doi:10.1071/AN12295.
- Jacobs JL, McKenzie FR, Ward GN (1999) Changes in the botanical composition and nutritive characteristics of pasture, and nutrient selection by dairy cows grazing rainfed pastures in western Victoria. *Australian Journal of Experimental Agriculture* **39**, 419–428. doi:10.1071/EA98161.
- Jansen, J, CDM Steuten, RJ Renes, N Aarts, and TJ Lam. 2010. "Debunking the myth of the hard-to-reach farmer: Effective communication on udder health." *Journal of Dairy Science* 93:1296-1306
- Kahneman, Daniel. 2011. *Thinking, Fast and Slow*. New York: Farrer, Straus and Giroux.
- Kaine, Geoff, and Vic Wright. 2016. Rates of adoption and compliance in dairy farming: Summary report. Hamilton: Geoff Kaine Research.
- Kenny S, Drysdale G (2009) Working on a new frontier: exploring the methodological challenges of addressing complex problems. *Extension Farming Systems Journal* **5**, 23–32.
- Kenny, Sean, and Geoff Drysdale. nd. Addressing the feedbase challenge through action learning (Final Draft). Unpublished: Dairy Australia.
- Kim, Jong-Sun, and Donald Cameron. 2013. "Typology of farm management decision-making research." *International Journal of Agricultural Management* 2

(2):81-90.

- Kuehne, Geoff, Rick Llewellyn, David J Pannell, Roger Wilkinson, Perry Dolling, Jackie Ouzman, and Mike Ewing. 2017. "Predicting farmer uptake of new agricultural practices: A tool for research, extension and policy." *Agricultural Systems* 156:115-125.
- Linehan CJ, Armstrong DP, Doyle PT, Johnson F (2004) A survey of water use efficiency on irrigated dairy farms in northern Victoria. *Australian Journal of Dairy Technology* **44**, 131-136.
- Master R, Bowyer J, Heath R (2009) The 'Profitable perennials' project: A case study. *Extension Farming Systems Journal* **5**, 191-195.
- McDonagh J, O'Donovan M, McEvoy M, Gilliland TJ (2016) Genetic gain in perennial ryegrass (*Lolium perenne*) varieties 1973 to 2013. *Euphytica* **212**, 187-199. doi:10.1007/s10681-016-1754-7.
- McKenzie FR, Jacobs JL, Kearney G (2003) Long-term effects of multiple applications of nitrogen fertiliser on grazed dryland perennial ryegrass/white clover dairy pastures in south-west Victoria. 2. Growth rates, dry matter consumed, and nitrogen response efficiencies. *Australian Journal of Agricultural Research* **54**, 471-476. doi:10.1071/AR02188.
- Mather, Mara, Eldar Shafir, and Marcia K Johnson. 2000. "Misremembrance of Options Past: Source Monitoring and Choice." *Psychological Science* 11 (2):132-138.
- Mckenzie F, Jacobs J, Ward G (2004) Dairy pasture yield and growth responses to summer and spring grazing. In '34th Agron. Soc. Conf.', Ashburton, New Zealand. 21-30. (Agronomy Society of New Zealand: Ashburton, New Zealand) https://www.agronomysociety.org.nz/uploads/94803/files/2004_4_Pasture_response_to_summer_spring_grazing.pdf.
- Neal JS, Fulkerson WJ, Lawrie R, Barchia IM (2009) Difference in yield and persistence among perennial forages used by the dairy industry under optimum and deficit irrigation. *Crop & Pasture Science* **60**, 1071-1087. doi:10.1071/cp09059.
- Neal M, Neal J, Fulkerson WJ (2007) Optimal Choice of Dairy Forages in Eastern Australia. *Journal of Dairy Science* **90**, 3044-3059. doi:10.3168/jds.2006-645.
- Niska M, Vesala HT, Vesala KM (2012) Peasantry and entrepreneurship as frames for farming: Reflections on farmers' values and agricultural policy discourses. *Sociologia Ruralis* **52**, 453-469. doi:10.1111/j.1467-9523.2012.00572.x.
- Nuthall, Peter. 2009. "Modelling the origins of managerial ability in agricultural production." *The Australian Journal of Agricultural and Resource Economics* 53:413-436.
- Pannell DJ (2006) Flat earth economics: The far-reaching consequences of flat payoff functions in economic decision making. *Review of Agricultural Economics* **28**, 553-566. doi:10.1111/j.1467-9353.2006.00322.x.
- Reid, Janet, David Gray, and Hannah Bruce. 2013. "Enriching the farm-management consultancy theory: practice nexus." *Extension Farming Systems Journal* 9 (1):99-103.
- Savage J, Lewis C (2005) Applying science as a tool for dairy farmers. In 'Proc. New Zeal. Grassl. Assoc.', New Plymouth, New Zealand. 61-66. (New Plymouth, New Zealand)
- Shaw, Penny, and Phil Shannon. 2013. "Coping with unchosen change – an extension practitioner's perspective." *Extension Farming Systems Journal* 9 (1):67-74.
- Shleifer, Andrei. 2012. "Psychologists at the Gate: A Review of Daniel Kahneman's 'Thinking, Fast and Slow'." *Journal of Economic Literature* 50 (4):1080-1091.
- Sewell AM, Hartnett MK, Gray DI, Blair HT, Kemp PD, Kenyon PR, Morris ST, Wood BA (2017) Using educational theory and research to refine agricultural extension: affordances and barriers for farmers' learning and practice change. *Journal of Agricultural Education and Extension* **0**, 1-21. doi:10.1080/1389224X.2017.1314861.
- Sinnett A, Ho CKM, Malcolm B (2016) Expanding a dairy business affects business and financial risk. *Animal Production Science*.
- Sloan J, Ryan M (2006) Farmers of the future: responsive, adaptable and profitable. *Extension Farming Systems Journal* **5**, 157-161.
- Tappin, Ben M, Ryan T McKay, and Leslie van der Leer. 2017. "The Heart Trumps the Head: Desirability Bias in Political Belief Revision." *Journal of Experimental Psychology: General* 146 (8):1143-1149.
- Tetlock, Philip E. 2002. "Social Functionalist Frameworks for Judgment and Choice: Intuitive Politicians, Theologians, and Prosecutors." *Psychological Review* 109 (3):451-471.
- Waters, Warwick, Don Thomson, and Ruth Nettle. 2009. Client Stocktake - Final Report. Melbourne: Dairy Australia.
- Webster, Neil. 2017. Interim Progress Report: Taking Stock (part of the Tactics for Tight Times program). Melbourne: Dairy Australia.