Contributed paper

DAIRYFARMER PERCEPTIONS AND ATTITUDES TO FEMALE GENOMIC TESTING

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SUMMARY

Increasing the adoption of female genomic testing, as a driver to accelerate the rate of genetic gain for net profit is a key priority for the Australian dairy industry. The aim of this research was to understand the motivations and barriers to adoption of female genomic testing through semi-structured interviews and self-administered questionnaires. The results showed that farmer awareness of genomics was high, but many had limited understanding of the practicalities of testing. An awareness-building campaign should therefore focus on building understanding of how genomics fits within a farm business. Ensuring farmers have the necessary support to make use of their results will be critical in achieving sustainable adoption. These findings provide the 'people perspective' to inform research, development and extension strategies to increase the rate of adoption of female genomic testing by farmers.

INTRODUCTION

Commercial genomic testing of bulls began in Australia in 2011 and has played a significant role in increasing the rate of genetic gain in the Australian dairy herd and the range of traits (Pryce *et al.* 2018; Newton *et al.* 2021). Adoption of genomic testing of bulls has been rapid. Of the Holstein and Jersey bulls registered for artificial breeding and born in the past 5 years, 91% and 84%, respectively, have genotypes included in DataGene's genetic evaluation.

Genomic testing of females has the potential to enable a quantum leap in genetic gain in the Australian dairy herd. It offers significant benefits to individual dairy herds (Newton *et al.* 2021). Genomic testing of females at a young age gives dairy farmers the ability to identify high, medium and low genetic merit animals and the opportunity to manage them differently (DataGene 2019b). The ImProving Herds project determined that the direct benefits of genomics outweighed the testing costs in more than half Australian herds (Newton *et al.* 2018) with the greatest benefits being in herds with low replacement rates and high reproductive performance. DataGene reports that around 20,000 females are tested annually which is less than 1% of heifers born each year. As a proportion of the number of herd recorded cows, the animals genotyped in Australia is 4% (DataGene 2019a, 2020) compared to 22% reported by the Council on Dairy Cattle Breeding in the USA (2020).

Previous studies have shown that farmer breeding choices and attitudes towards genetics vary (Nettle *et al.* 2010; Martin-Collado *et al.* 2015; Ooi *et al.* 2021). The aim of this study was to better understand farmers' motivations to undertake routine female genomic testing and the barriers to adoption in order to advise the development of industry communication and extension activities directed at increasing the rate of genomic testing.

MATERIALS AND METHODS

We conducted semi-structured telephone interviews with 17 dairy farmers and two managers of commercial GSP (GSP) businesses. The interviews involved a semi-structured conversation process that captures what people think and enables participants to reflect on why they hold these views (Stanfield 1997). Interviewee selection was based on purposeful sampling (Patton 2002). We aimed

to gather a full range of perspectives while understanding that it is more likely that ideas are repeated as the number of interviewees increases (Ooi *et al.* 2021). We interviewed two managers from GSP first, to gain insight from their broad experience in discussing genomics with farmers.

Discussion topics for farmer interviews were modified slightly according to their level of interest in genomics which we described as: 'genomics convert', 'genomics is on my radar', and 'non-converts'. Number of interviewees for each of these categories were 7, 8 and 2; respectively.

The self-administered survey of commercial GSPs was conducted through email with follow up phone calls to prompt responses. The survey asked GSPs what they thought were motivations for, and barriers to, the adoption of genomic testing by farmers, based on experience. Eight people from GSPs were invited to participate, with seven responses received by the deadline.

Responses from both interviews and survey were collated and similar ideas were grouped into themes by the research team.

RESULTS AND DISCUSSION

The initial attractions of genomics were similar across all farmer interviewees, with the two biggest attractions being parentage verification (especially for crossbred or large herds with intensive calving blocks) and to identify heifers to keep as replacements and not having the expense of rearing those animals unlikely to perform in the herd (Table 1). With experience, converts had discovered additional benefits of female genomics, e.g. identifying suitable candidates for sexed semen to breed replacements and beef semen as a terminal cross which are more sophisticated applications to their business.

Table 1. Reasons why farmers genomic test females

Parent (and pedigree) verification, especially in herds with crossbreeding programs or large herds with intensive calving batches.
Heifer rearing decisions • Select the right heifers to rear as replacements • Sell heifers that don't have a future in the milking herd *("Identify the tail end of the herd")*
Breeding decisions • Matching different types of straws to animals of high, medium, and low genetic merit (e.g. sexed over high; conventional over medium, beef over low) • Monitor impact of breeding decisions
Business decisions: developing alternative income streams e.g. elite genetics, heifer exports.

Overwhelmingly, the non-convert farmer interviewees had heard of genomics, and the ability to test young females, however their understanding was limited in terms of how the test worked, the costs involved, practicalities of sampling, the application of the results to decision making and the benefits/value to their business. This presents a communication challenge, as one GSP pointed out: "*Nobody wants to look silly and admit they don't know about genomics."*

There appeared to be regional variation in understanding, with it being greater in areas where peers had tried genomics. For example, in Western Australia, 'everyone around us is testing' so hearing peer success had given them confidence in genomics.

The lack of commercial genomic service for crossbred and minority breeds was a barrier for some farmers in the 'on my radar' category.

Barriers cited by 'non-convert' interviewees fell into the following themes: the herd/business was not yet ready for genomics, other priorities, logistics, costs and confidence in the technology. The barrier of 'other priorities' has been previously recognised in the context of animal breeding and genetics extension programs (Dodd *et al.* 2015) and highlights the need for repeated activities

to maintain farmers' awareness of, and interest in female genomics.

One interviewee summed it up as: "*Genomics is currently in my too hard basket and it's easier to justify spending money elsewhere."*

Converts reported similar concerns before deciding to test. While the cost was initially off-putting, converts' focus changed from cost to 'value' of genomics once they began using the results. This is reflected in the very high repeat testing rate (at least 80%) reported by GSPs interviewed and surveyed. Both converts and GSPs confirmed that the logistics of sampling, especially the first time, was a genuine challenge for many farmers. This could be overcome with practical support and farm protocols to incorporate the testing process into routine activities such as vaccination and disbudding or calf feeding. GSPs also highlighted the importance of providing follow up support, tools and reports to help farmers interpret the results and make breeding and management decisions. They saw it as vital to take people through the results the first time with some farmers needing ongoing support (with each new set of results).

Based on these insights, the research team developed a four-phase adoption pathway for female genomic testing in Australian dairy herds: awareness and understanding, consideration and overcoming barriers, deciding and sampling and interpreting and applying the results (Figure).

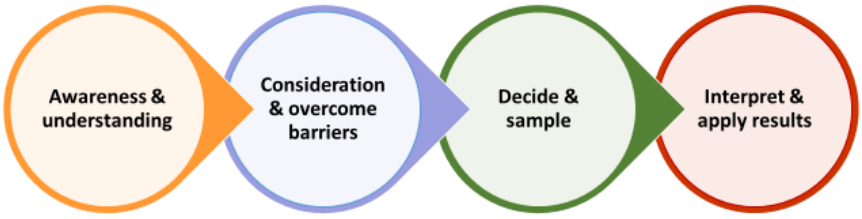

Figure 1: Adoption pathway for female genomics by farmers

This pathway has some similarities with the Transtheoretical model of behaviour change (Prochaska *et al.* 1992). It has formed the basis of developing and delivering a communication and extension program to fast track the uptake of female genomics by the Australian dairy industry.

The communication and extension program requires tailored communication formats for the different stages of the adoption pathway. Nettle *et al*. (2010) and Ooi *et al*. (2021) have previously reported that farmers' decisions are influenced by a range of advisors. Therefore, a collaborative approach across the herd improvement industry is expected to be the most effective way to support farmers in their journey along the adoption pathway for female genomics. Different actors in the industry are better equipped to deliver via different communication formats (Table 2). Online delivery formats offer the opportunity to allow farmers to engage with communication and extension resources when the time is right for their individual circumstances.

This study found that Australian dairy farmers have heard of genomic testing but understanding and application of the test results is variable. Those who have not previously tested have limited understanding of the costs, practicalities of sampling, the application of the results and the benefits/value to their business. One-way communication involving mass media is essential in maintaining awareness and can help build understanding. However, fast-tracking adoption will also require interactive communication such as group activities, learning resources and, in some cases, individual one-on-one support.

Table 2: Communication formats suited to stages in the adoption pathway

Stage in adoption pathway	Communication/extension formats	Potential delivery partners
Awareness and understanding	Mass media, including industry/trade media, print, digital, social media.	Dairy Australia (DA) DataGene, GSPs
Consideration and overcoming barriers	Group activities e.g. such as pub nights, field days, discussion groups, local industry events. Peer testimonials and case studies.	Regional Programs DataGene, GSPs
Decide and sample	Special interest discussion groups (virtual) One-on-one conversations Practical (on-farm) support with sampling Tools / resources e.g. how-to videos, checklists	DataGene GSPs Dairy Australia
Interpret results and apply to decisions	Practical (one-on-one) support One-on-one conversations, individual support Learning resources (including online) Report demonstrations (including online) Special interest discussion groups (virtual)	GSPs, DataGene Breeding Advisers Semen resellers Dairy Australia

CONCLUSIONS

Understanding the hurdles and motivations for on-farm adoption of female genomic testing adds to the existing knowledge of genetic trends. These insights provide the 'people perspective' to inform research, development and extension strategies designed to increase the rate of adoption of female genomic testing by farmers. The proposed adoption pathway can inform the development of a communication and extension program to promote the uptake of female genomics in dairy herds.

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