MERINOLINK/UNE DNA STIMULATION PROJECT: DOUBLING THE RATE OF GENETIC GAIN - WHERE ARE WE AT IN YEAR 2?

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SUMMARY

The MerinoLink/UNE DNA Stimulation Project is a major genetics adoption program in Merino sheep breeding enterprises running from January 2018 to June 2022. The collaborative approach between MLA Donor Company, University of New England, MerinoLink Limited and the project participants has already started to meet the project target of doubling the rate of genetic gain by 2022. The project focusses on working with the project participants to strategically use the genetic and genomic tools currently available. A major component of the adoption strategy has seen the total financial contribution from all participants equating to upward of $1.7 million. In a time of poor seasons recently, this is a significant commitment for participating seed stock breeders to improve their genetic gain.

DNA Parentage and low density genomic testing has allowed Merino seed stock breeders to capture relationships between animals to enhance accuracy of the estimated breeding value predictions, hence improving the rate of genetic gain. In the first year of the project participants have increased the rate of genetic gain within the group by 2.4 Index and are 5 MP+ index points higher than the rest of the MERINOSELECT database when comparing average index improvement.

Flock Profile and RamSelect's Ram Team Manager are tools commercial breeders are using to benchmark the genetic merit of their Merino flocks. This information is aiding participants to make better ram selection and buying decisions to increase genetic merit of their flocks.

INTRODUCTION

On average genetic gain in Merinos is currently low with very large variations across the industry (Granleese *et al.* 2018). Underlying influences are caused by a multitude of factors including inaccurate breeding values (Stephen *et al.* 2018) and/or a lack of understanding of selection theory. The DNA Stimulation Project aims to build understanding and implementation of genetic selection tools. The project focusses on capacity building and working collaboratively at all levels across the industry to communicate how to more effectively use software tools for assisting in the design of breeding programs to increase the rate of genetic gain for participants.

The Project has 30 ram breeders and 18 commercial breeders participating who breed their own rams, 52 commercial breeders who purchase rams and a number of service providers. The project participants are located across New South Wales, Western Australia and Victoria. In total the ram breeders sell 8,500 rams and 19,000 doses of semen annually to over 1,600 ram buying clients. If it is assumed that each ram sold is used for an average of 2.5 mating years and sire 75 lambs per mating year, this means the rams produced by the participant studs will sire ~1.6 million commercial Merino sheep annually. Semen and stud sires used at nucleus level will also influence the broader Merino population directly and indirectly through daughters. Furthermore, commercial participants of the project run a combined number of 575,000 Merino sheep annually.

The aim of the DNA Stimulation Project is to double the annual rate of genetic gain by 2022 (starting in 2018) in line with the National Livestock Genetic Consortium's aims. This paper outlines methods the project uses and provides a progress report of how participants are working towards this goal.

MATERIALS AND METHODS

Project participants sign an agreement to be part of the DNA Project. The project expectations are agreed, and the funding is 58 percent from the project participants and 42 percent from the Meat and Livestock Donor Company.

Key tools used with project participants include DNA parentage, low density genomic tests, Flock Profile genomic tests, Australian Sheep Breeding Values (ASBVs), Sheep Genetics Ramping Up Genetic Gain report (RUGG), Flock Profile (Swan *et al.* 2018), Ram Team Manager (RamSelect.com.au), Rampower within flock indexes and percentile band tables.

The extension and adoption process include a combination of workshops, intensive one-on-one meetings, webinars, phone calls, personal emails, e-newsletters and group email updates. Input for all of these include key personnel within University of New England, Sheep Genetics, Meat and Livestock Australia and participants in the project, including breeders and genetics service providers. Each project participant works through the process of setting an achievable breeding objective which is revisited each workshop or meeting with the project coordinators or service provider. Key questions are covered – are they on track, what is working well (or not), what can be improved, and how are project participants measuring progress?

To measure progress the DNA project uses tools, such as rates of genetic gain, as generated by Sheep Genetics, and workshop feedback, to track the effectiveness of the project. In this project we use the Merino Production Plus (MP+) index as the genetic progress benchmark. "Doubling the rate of genetic gain" will be measured by comparing the five-year genetic gain average compared to the project five year genetic gain average.

RESULTS AND DISCUSSION

A key outcome of the project to date, includes the use of DNA testing technologies to increase the number of ram breeders' participants submitting data to Sheep Genetics with full pedigree. There has been an increase in the number of project participants submitting full pedigree from 25% to 34% between January 2018 and January 2019 shown in Table 1.

Between the start of the DNA Project in late 2017 and the end of April 2019, the project participants have utilised 43,831 DNA parentage tests, 60 Flock Profiles and 11,779 low density genomic tests. The majority of the ram breeders involved the project have now tested their ram breeding nucleus (dams, replacements and sires) with either DNA parentage or low density genomic information. Breeders who have not used DNA parentage testing will maintain their pre-project mothering programs.

Table 1. Average proportion pedigree submission to Sheep Genetics for project participants

	Full Pedigree	Sire Only Pedigree	Dam Only Pedigree	Syndicate Pedigree	No Pedigree
1-Jan-18	0.25	0.41	NA	0.25	0.09
1-Jan-19	0.34	0.38	0.01	0.21	0.07

There is a large range of genetic merit between the ram breeder participants in the DNA Project, with the lowest average MP+ index 110 and the highest 167 MP+ index points. This diversity in the group is being used to share and swap experience to allow informal mentoring within the group.

Overall the collective ram breeder participant index trend from the 2017 to 2018 lamb drop have increased by 2.4 index points. However, the project was not in place when the 2018 drop was conceived, but improved data collection methods were. Hence the project can only claim some of the credit for the improved rate of genetic gain. The 2018 average index is 5.0 points higher than the

Merino industry average (Figure 1). The 2019 drop, which is yet to be measured and submitted to Sheep Genetics will be the first drop of lambs where the project has had full involvement of mating and performance recording.

Ten percent of the ram breeder participants first used Matesel (Kinghorn 2011) for mating allocations for the 2019 joining. The biggest limitation for many of the project participants to utilise Matesel in the past has been the lack of full pedigree data.

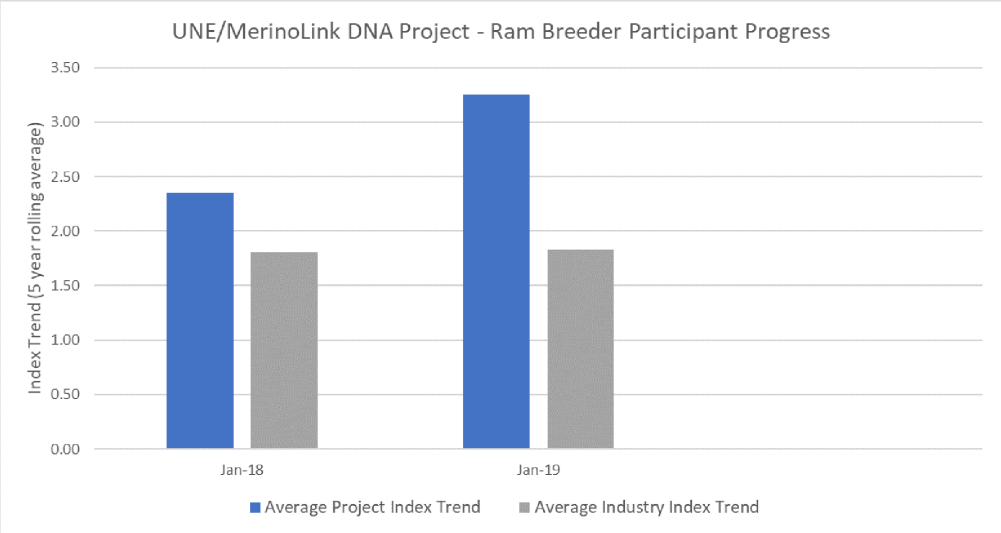

Figure 1. Average index for project participants (grey) and MERINOSELECT members (blue)

Key times identified in the project to provide information, data and advice to assist in decision making are when breeders are setting and reviewing their breeding objectives and developing their mating programs. The majority of the one on-one-ram breeder meetings are planned to coincide with strategic times in their calendar of operations. The one-on-one meetings allow for detailed investigation of the Sheep Genetics' Ramping Up Genetic Gain (RUGG) reports, Sheep Genetics Genetic Trend reports and other information associated with seasonal conditions (constraints).

An annual workshop is run with the project participants. The aim of the ram breeder workshops is to disseminate genetic extension material, update the breeders with their current genetic reports (RUGG) from Sheep Genetics and network with service providers and peers. To date there have been two workshops held for the ram breeders, with 86% able to attend. The overall satisfaction and relevance of the material and content of the workshop has been rated 9.2 and 8.8 out of 10, respectively.

All ram breeder workshop participants were asked what the major obstacles were in implementing changes to enhance progress towards their breeding objective and improve genetic gain. Time and labour ranked first; costs associated with data collection and seasonal conditions ranked second and genomic turnaround time, database integrity, communication and risk vs reward (birth traits) ranked third.

Commercial breeder workshops have also been held, 6 in total to date. These workshops aim to disseminate genetic extension material, review Flock Profile results, update Ram Team Manager and review breeding objectives in order to set actions for the coming 6 to 12 months. Currently 85% of commercial ram breeder participants that attended workshops have at least one ram team registered in RamSelect.

Table 2. Averaged responses to all breeder workshops conducted in 2018

Pre-Workshop Question	Score (Pre)	Post-Workshop Question	Score (Post)
How would you rate your current use of ASBVs when selecting rams for your ram breeding operation?	6.8	After today's workshop how do you rate the importance of using ASBVs in ram selection to reach your breeding objective?	8.8
How would you rate your current use of ASBVs when selecting ewes for your ram breeding operation?	5.4	After today's workshop how do you rate the importance of using ASBVs in ewe selection to reach your breeding objective?	8.4
Are you using the Sheep Genetics website/database to search and sort animals to purchase and/or source semen?	5.5	How confident are you following today's workshop in being able to improve your utilisation of MERINOSELECT and the Sheep Genetics website?	8.5
How would you rate your current knowledge of Matesel?	4.0	After today's workshop, how important do you see the use of Matesel in making the best possible mating decisions?	7.5
How would you rate your current use of Matesel?	3.0	After today's workshop, how confident do you feel to use Matesel in making the best possible mating decisions?	7.2

CONCLUSIONS

Progress is being made, although it is too early to call the project a success. There are positive signs with breeder satisfaction in training, extension and adoption. As more data continues to flow in annually, we will be able to more accurately describe the impact of this unique project.

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