

MERINOLINK/UNE DNA STIMULATION PROJECT: DOUBLING THE RATE OF GENETIC GAIN – WHERE ARE WE AFTER 4 YEARS?

S.J. Martin^{1,2,3,4,5} and T. Granleese^{2,3,4,5}

¹Sally Martin Consulting Pty Ltd, Young, NSW, 2594 Australia

²Meat and Livestock Australia, Armidale, NSW, 2351, Australia

³University of New England, Armidale, NSW, 2351, Australia

⁴NSW Department of Primary Industries, Grafton, NSW, 2460, Australia

⁵MerinoLink Limited, Young, NSW, 2594, Australia

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 is between MLA Donor Company, University of New England, MerinoLink Limited and the project participants. 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.

Thirty seedstock Merino breeders are currently on-track to hit the project target of doubling the rate of genetic gain by 2022. This has been facilitated through an annual cycle of intensive mentoring, workshops, networking and use of breeding decision tools within the group.

Commercially available 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 has been used to aid participants in better ram selection and buying decisions to increase genetic merit of their flocks. In the final phase of the project commercial breeders will conduct a second Flock Profile to measure their genetic gain and cross reference this information to the Ram Team Manager predictions (where applicable).

INTRODUCTION

Historically, 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 has been building understanding and implementation of genetic selection tools with the project participants. The project focusses on capacity building and working collaboratively at all levels across the industry to communicate how to use software tools more effectively 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 7 service providers. The project participants are located across New South Wales, Western Australia and Victoria.

During the DNA Stimulation Project, project participants have been faced with significant challenges including drought in many parts of Australia and unprecedented restrictions due to COVID-19. The project team has been able to adapt to the situation and continued to deliver the project requirements.

The aim of this project is to double the annual rate of genetic gain by 2022 (starting 2018) by maximising the adoption of a set of tools by breeders involved in the project. This paper outlines methods the project has used and provides a progress report of how participants are working towards this goal in year 4 of a 5-year project.

MATERIALS AND METHODS

Project participants signed an agreement to be part of the DNA Project outlining project expectations between project leaders and participants. The project is co-funded with 58 percent contributed from the project participants and 42 percent from the MLA Donor Company. UNE were financial guarantors and provide genetic technical support in conjunction with MerinoLink facilitated genetic service providers. Sheep Genetics have also been fully engaged and supportive of the project.

Key tools used with project participants include DNA parentage, low density genomic tests, Australian Sheep Breeding Values (ASBVs), MateSel (Kinghorn 2011), 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 face-to-face workshops, intensive one-on-one meetings, webinars, phone calls, personal emails, e-newsletters and group email updates. Input into these processes include key personnel within the DNA Project Team, University of New England, Sheep Genetics, Meat and Livestock Australia and participants in the project, including breeders and genetics service providers.

To measure progress the DNA Stimulation 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

The key outcomes of the project to date includes the strategic use of DNA testing technologies to increase the number of ram breeder 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 53% between January 2018 and January 2021, shown in Table 1.

Table 1. Average proportion pedigree submission to Sheep Genetics for ram breeder project participants on a five year rolling average

Year Drop	Full Pedigree	Sire Only Pedigree	Dam Only Pedigree	Syndicate Pedigree	No Pedigree
2017*	0.25	0.41	NA	0.25	0.09
2018	0.34	0.38	0.01	0.21	0.07
2019	0.43	0.34	0.01	0.13	0.09
2020	0.53	0.29	0.01	0.08	0.09

*Pre-project for starting reference point

During the first half of the project, 2018 to 2019, co-funding was provided for DNA testing. The project participants used this co-funding to conduct 48,691 DNA parentage tests, 62 Flock Profiles and 13,236 low density genomic tests (January 2018 to June 2019). The majority of the ram breeders involved in the project have now tested their entire ram breeding nucleus (dams, replacements and sires) with either DNA parentage or low-density genomic information.

After June 2019 all DNA parentage and low density genomic tests has been fully funded by the project participants, with over 40,000 tests being conducted annually by the ram breeders (now 60% low density genomic tests).

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 at the commencement of the project in 2017. The current MP+ index range between the ram breeders is 134 to 175 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. Each January the project participant progress is benchmarked to the rest of the industry to assess progress, in 2019 the average index was 5.0 points higher than the Merino industry average (Figure 1) and 2020 and 2021 it was 11 points higher.

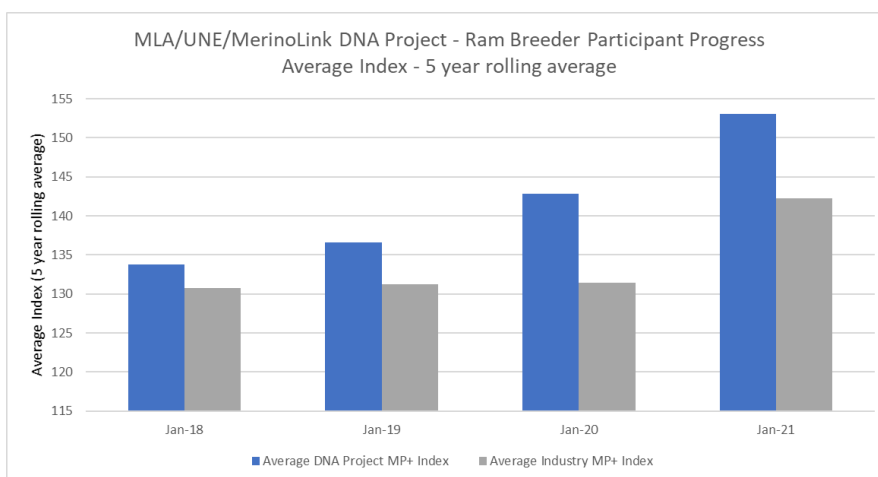


Figure 1. Average 5 year rolling index for project participants (blue) and all MERINOSELECT members (grey)

Ten percent of the ram breeder participants first used Matesel (Kinghorn 2011) for mating allocations for the 2019 joining, in 2021 this has increased to 48 percent. The biggest limitation for many of the project participants to utilise Matesel in the past has been the lack of full pedigree data which is being addressed with the increased uptake of DNA parentage and low-density genomic testing to gather pedigree information.

The ram breeder participants have embraced additional data collection as breeders advance to include traits that are not included in industry indexes in their breeding program, for example fly strike indicator traits. The combined DNA Project participants contribute 38 and 44 percent of the early breech wrinkle data on the 2019 and 2020 drops respectively.

DNA parentage testing has enabled ram breeder DNA Project participants to readily collect data on key reproduction traits, including litter size (LS), conception (CON) and ewe rear ability (ERA). Between the year of joining (YOJ) 2016 and 2020 there has been a 17 percent increase in data submitted to MERINOSELECT for ERA by the project participants. For the 2020 YOJ the DNA Project ram breeder participants are contributing 43, 39 and 29 percent of the MERINOSELECT database for CON, LS and ERA, respectively.

Key times identified in the project to provide information, data and advice to assist project participants in decision making are when breeders are setting and reviewing their breeding objectives and developing their next mating programs. The majority of the one on one ram breeder meetings are planned to coincide with strategic times in their calendar of operations.

There is a direct correlation between attending educational activities and rates of genetic gain (Brown 2019). Figure 2 demonstrates that the more engaged ram breeder project participants are with the project the higher the rates of genetic gain. This trend validates the intense relationship the

breeders have with the project team and MLA and UNE funding.

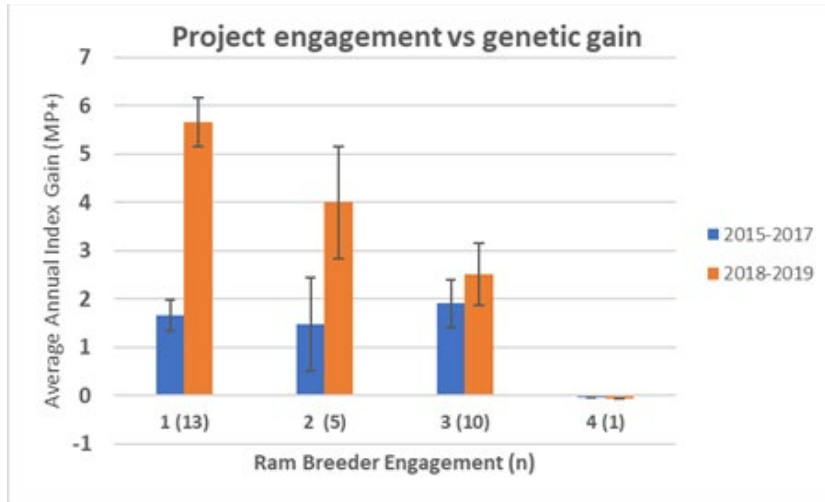


Figure 2. Average annual genetic gain grouped by breeder engagement. Group 1 - attends all workshops and requests one-on-one meetings; Group 2 - attends a combination of most workshops and/or requests one-on-one meetings; Group 3 - attends some workshops and rarely one-on-one meetings; Group 4 - no engagement

CONCLUSIONS

Progress continues to be made with the project participants and as the project draws to a conclusion in 15 months' time the full impact of the project will be able to be described. This project is on track. It has and continues to deliver positive breeder satisfaction in training, extension, and adoption.

ACKNOWLEDGEMENTS

The MerinoLink/UNE DNA Stimulation Project is funded by the Meat and Livestock Australia Donor Company (MDC) [P.PSH.0961], University of New England, and all the project participants. Daniel Brown of AGBU and Emma McCrabb of Sheep Genetics are thanked for providing some data for this paper and their ongoing technical support to the project.

REFERENCES

- Brown D.J. (2019) *Leading Breeder Conference*, Dubbo, NSW, Australia.
- Granleese T., Clark S.A., Duijvesteijn N., Bradley P.E., and van der Werf J.H.J. (2018) *Animal Production Science* **Published online:** <https://doi.org/10.1071/AN17720>.
- Kinghorn B.P. (2011) *Genetics Selection Evolution* **43**: 4.
- Stephen, L., Brown D., Jones C., and Collinson C. (2018). *WCGALP* **11**: 433
- Swan A.A., Gurman P.M., Boerner V., Brown D.J., Clark S.A., Gore K., Granleese T. and van der Werf J.H.J. (2018) *WCGALP* **11**: 346.
- RamSelect website – www.ramselect.com.au