



AWI Program Manager Genetics and Animal Welfare Advocacy, **Geoff Lindon** (second from right), Murdoch University researchers **Andrew Thompson** (fourth from left) and **Sarah Blumer** (fourth from right), with the **Murdoch team** and a sedated wether ready for the DEXA measurement. (The clipped patch on the wether's side is for assessing changes in wool growth in different diets.) PHOTO: Bob Garnant, Countryman WA

Can we find a better way to compare sheep performance?

An AWI-funded study with Murdoch University aims to determine if it is possible to improve current estimates of profitability per hectare, by assessing feed intake and total body energy reserves rather than the current blunt use of metabolic body weight (DSE rating).

Since Merino sheep first touched Australian soil, breeders have been selecting for animals that produce more wool, better wool and, in more recent times, more lambs and more meat. Past and present breeders have been successful at improving the Merino sheep we farm with today, and Merino productivity per head continues to climb.

Despite these great advances, there are still many things that we do not understand about the biology that underpins the changes that we see on the surface. We could be excused for thinking that it does not really matter, that as long as the animals are getting more productive, it is not important as to how the animal is achieving the new level of performance. However, we do not run Merino sheep as individuals and we do not have unlimited feed resources on-farm, so it is important that we understand how genetic change is impacting on the inputs required. These inputs include nutritional quantity and quality, and level of husbandry

care, both of which affect the number of sheep that can be carried throughout the year and through variable seasons.

The animals in the Merino Lifetime Productivity (MLP) project have presented a perfect opportunity to start to build a greater understanding of how selection strategies are impacting on the underlying needs of the animal and its efficiency in creating wool and lamb outputs. Data collected on the MLP animals has provided a perfect platform to launch additional studies.

An important project known as GEPEP – which stands for Genetic Evaluation: Productivity, Efficiency and Profitability – is being funded by AWI and conducted by a team of researchers at Murdoch University in Western Australia. The project started in 2018 with significant experiments undertaken during 2019 and 2020 using the animal house at the Katanning Research Facility maintained by DPIRD. These trials have centred around

understanding differences that exist between F1 wether progeny from the MLP sires used at the Pingelly site for animal feed intake, weight loss under low feed availability, feed-use efficiency when gaining weight and energy storage across a range of nutritional regimes.

Do animals of the same liveweight differ in the amount they eat?

In any trial trying to compare bloodlines, whether wether trials, sire progeny tests or on-farm comparisons, we have always assumed that the intake of animals is directly linked to how much they weigh. That is, we assume that the heavier animals are eating more, and we make an adjustment to their profitability based on a lower predicted stocking rate.

Unfortunately, this is a very blunt and inexact method as it assumes there are no efficiency differences between sheep



DEXA image of a wether for the assessment of the carcass components of fat and lean tissue.

genotypes of the same weight. We have seen in the MLP trial that some sire groups end up in considerably higher condition scores under the same conditions suggesting some fundamental differences between progeny groups.

To appropriately compare sheep genotypes, we need to understand the magnitude and importance of these differences. This is one of the key parts of the GEPEP project. Sire groups of wethers have been fed in individual pens throughout the course of the GEPEP experiments so that an accurate measure of feed intake can be calculated, and sire groups compared.

Yes, genotypes do vary in feed intake at the same liveweight.

Do animals differ in the way they store energy and how much they store?

The GEPEP project team has measured differences between genotypes in the total body energy store. The measurements were done using dual energy X-ray absorptiometry (DEXA) and have also been assessed with less intensive measurements in an attempt to identify a suitable on-farm test.

These differences are likely to reflect in differences in the ability to farm the animals at high stocking rate or differences in the supplementary feeding needs.

Similar to feed intake, these differences in whole body energy reserves between sheep genotypes have not previously been considered when valuing the differences between sires or bloodlines.

These differences do seem to be significant when we study previous work and the results from the MLP project clearly show that sire groups differ in their condition score when run together. In order to fully understand these differences and what it might mean for comparison of sire groups, whole-body energy reserves have been repeatedly measured on the MLP wethers throughout the GEPEP project.

The total energy reserves in the body are a combination of the total amount of lean tissue (made up of muscle and organs) and total amount of fat tissue. The energetic value of fat and lean tissue is then used to estimate the whole-body energy (measured in megajoules) of a sheep at a particular point in time. The differences in proportion of fat and lean tissue can have an impact on whole-body energy because 1 kg of fat tissue

stores about 36 MJ of energy whereas 1 kg of lean tissue only stores about 5 MJ of energy.

Understanding feed-use efficiency in Merino sheep

Having animals that eat less to achieve the same production has been an important aim across many livestock breeding programs. Considerable success has been achieved in the intensive livestock industries like chicken and pork but very little is known about how current selection strategies in Merino sheep impact on feed-use efficiency and whether there are ways that improvements could be made.

The GEPEP work has completed extensive measurement of feed-use efficiency under a range of feeding scenarios which are currently being analysed to learn more.

What have we learnt?

The main experimental phase of the project

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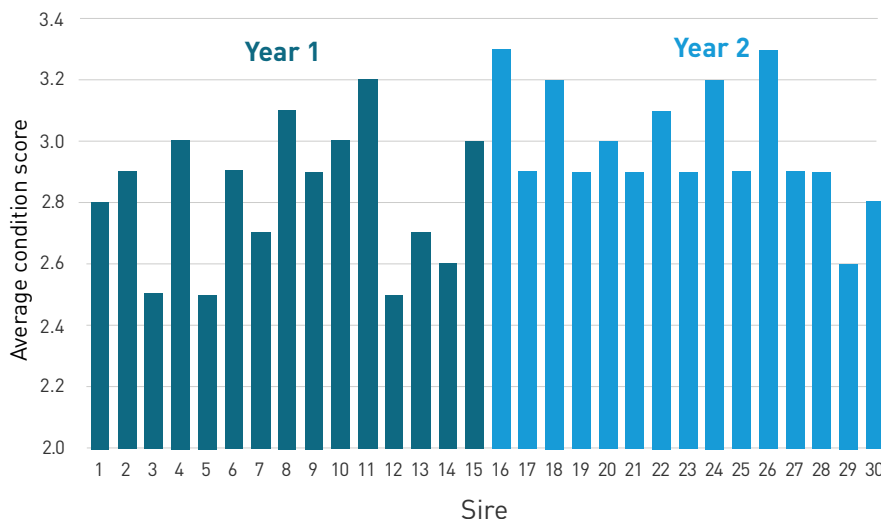


Figure 1. The **average condition score** of 3-year-old wether progeny from 15 different sires in year 1 (2016 drop) and 15 sires in year 2 (2017 drop). The progeny from each drop had grazed together since birth and their condition score was measured at the start of the experiment at the end of summer/early autumn.

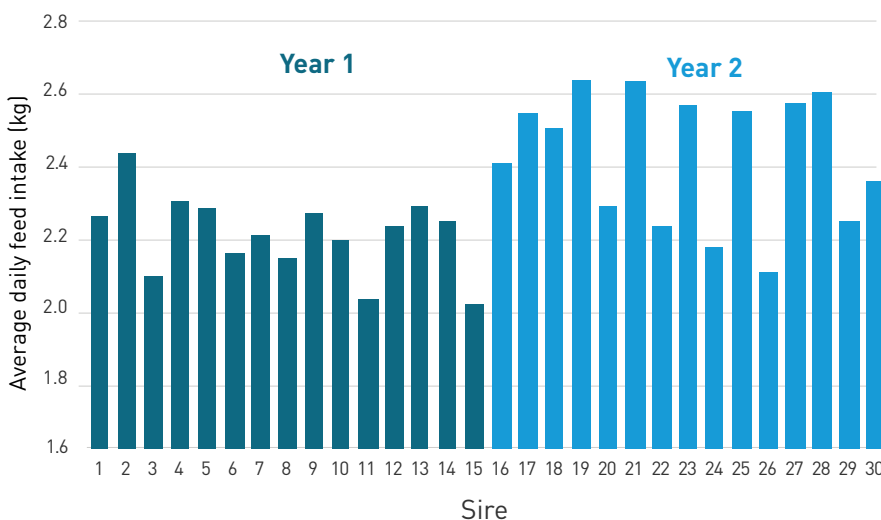


Figure 2. The **average daily feed intake** of 3-year-old wether progeny from 15 different sires in year 1 (2016 drop) and 15 sires in year 2 (2017 drop). The progeny were offered unlimited feed for 35-days in individual pens at the Katanning Research Facility. Clearly this difference between genotypes will have a big impact on a production system.

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was completed in 2020 and the project team is now busily combining and analysing the results. What has become clear throughout the project is the large variation that exists between sire groups for wool traits, carcase traits and energy stores or condition score. This was apparent even though the animals had been running in the same paddock since conception.

Readers will be well versed in condition scores with Lifetime Ewe Management guidelines suggesting Merino ewes should be around condition score 3 at key reproductive stages (see page 28). The LTEM course focuses on the management tools to help producers meet these targets, however there was also a significant difference in the condition score of different genotypes under identical management. The wether progeny groups from different sires varied as much as 0.7 condition score units in the GEPEP experiment (see Figure 1 on previous page).

The feed intake results from the work have also been fascinating. There are big differences between sire groups in how much the sheep ate when given unlimited opportunity (ad libitum feeding). The differences between sire groups were as much as 0.5kg per day or around 25% different (see Figure 2 on previous



Wethers for the individual pen trial component of the project at the DPIRD WA Katanning Research Facility.

page). Clearly this difference between genotypes will have a big impact on a production system.

Where to next for the project

All the results that have been generated throughout this important project will be analysed and combined. Then, prior to the project concluding in 2024, the aim will be to generate a new method to turn \$ per head assessments into \$ per hectare rather than continuing to use the current blunt liveweight adjustment used in genotype assessments.

The improved method will either use the existing wool and meat production per head data or combine existing data better

with new novel practical measurements to better predict profit per hectare.

In time, the project aims to provide ram breeders and buyers with a better understanding of the feed input implications of selection for various production traits through MERINOSELECT production indexes. It is a complex area and will take further refinement to get the efficiency gains that intensive livestock have achieved; however, that is the ultimate aim. **B**

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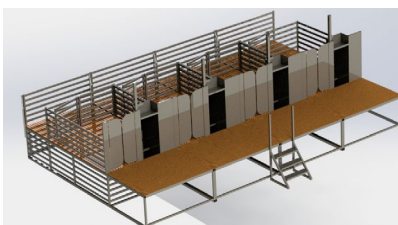
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