



Sheep CRC Practical Wisdom Notes

Document ID:	SheepCRC_25_47
Title:	Merinotech: Strategies to achieve a 100% PP nucleus Apr 2016
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Key words:	sheep; genetics; polled lambs; horn poll test

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It should be cited as:

Tom Granleese (2016) – *Merinotech: Strategies to achieve a 100% PP nucleus Apr 2016*

Merinotech: Strategies to achieve a 100% PP nucleus

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Key points

- PP animals will have 100% visually polled lambs regardless of mate's genotype
- Poll status is completely controlled by genetics
- Development of horns in sheep appears to be mostly controlled by a single gene
- Known PP rams attract at least a \$200 premium per ram at Merinotech ram sales

The genetics of horns and the Sheep CRC Poll Gene Test

Prior to development of the Poll Test, breeders had to rely on progeny testing to determine whether a polled ram carried a recessive horn gene (H). Breeders can now use the Poll Gene Test to identify true polled (PP) animals and dramatically reduce the occurrence of horned animals.

Three possible gene combinations, that determine whether a sheep is horned (H) or polled (P), have been identified: HH, PH or PP. Because the horned gene is recessive, horned animals (HH) must carry the trait from both parents. Animals with no horns can be either PP or PH. The PP are pure polled, but the PH are still carriers of the H gene; that is, they don't have horns themselves, but they can pass the horn gene on to their progeny. By using DNA testing to identify whether an animal is PP or PH, breeders can predict whether the progeny of a ram are more or less likely to have horns. The Poll Test is predictive of the horn status of tested animals. HH rams are almost always horned, whereas PH rams are rarely horned and PP rams are always polled. This test is currently costs \$17 + GST per head and is offered by the Sheep CRC.

Merinotech's motivation

Merinotech (WA) anticipates a \$200 premium for known PP status rams compared to rams of similar genetic merit with horns or unknown polled status. With such significant premiums on offer, Merinotech aim to move their nucleus to 100% known PP to maximise their poll premiums at sale time. They aim to use the Poll genomic test to identify and breed from PP animals to achieve this.

Current gene frequencies in Merinotech nucleus

Currently, Merinotech representatives estimate their breeding nucleus to have gene frequencies of 15% HH, 45% PH and 40% PP. 100% known PP status cannot be achieved without testing ewe selection candidates as alluded to by previous Practical Wisdom notes. The Sheep CRC ran a number of modelling scenarios to mirror Merinotech's current nucleus structure and to test genotyping strategies to reach 100% known PP in their nucleus. Merinotech's nucleus consists of 560 ewes which breed 650 lambs per year, with 100 lambs born via multiple ovulation and embryo transfer (MOET) and the rest from natural mating with full pedigree recorded.

Testing strategies

Ten testing strategies were investigated, where overall cost, as well as the number of male and female selection candidates, were tested each year and genetic gain was measured. If progeny from known PP parents were born, they did not require a Poll test. Furthermore, no HH animals were selected.

In all breeding programs, a maximum of 20% of ram selection candidates needed testing each year with only PP rams selected. The ten breeding programs differed by the number of ewe selection candidates tested. Proportions of ewe selection candidates tested ranged from zero to 100%. In all breeding programs, all known PP ewes were selected first based on genetic merit. If there were not enough PP ewe selection candidates, then highest ranking PH or P- (unknown poll status) ewes were selected.

Results

The fastest way to achieve a 100% known PP nucleus for Merinotech was to have at least 50% of ewe selection candidates budgeted to be tested for P/H (right y-axis of Figure 1). Budgeting for less would stretch out the time taken to reach 100% PP by an extra 2–3 years, despite the lower cost (left y-axis of Figure 1). The cost difference between testing 50% and 100% was roughly \$1800 less (Figure 1) over the 3 years, with annual cost of testing spread more evenly in the 50% scenario compared to the large up-front cost in the 100% and little in years 2 and 3 (Figure 2). In all scenarios, there was a slight slowing of rate of genetic gain before regaining previous rates of genetic gain (Figure 3).

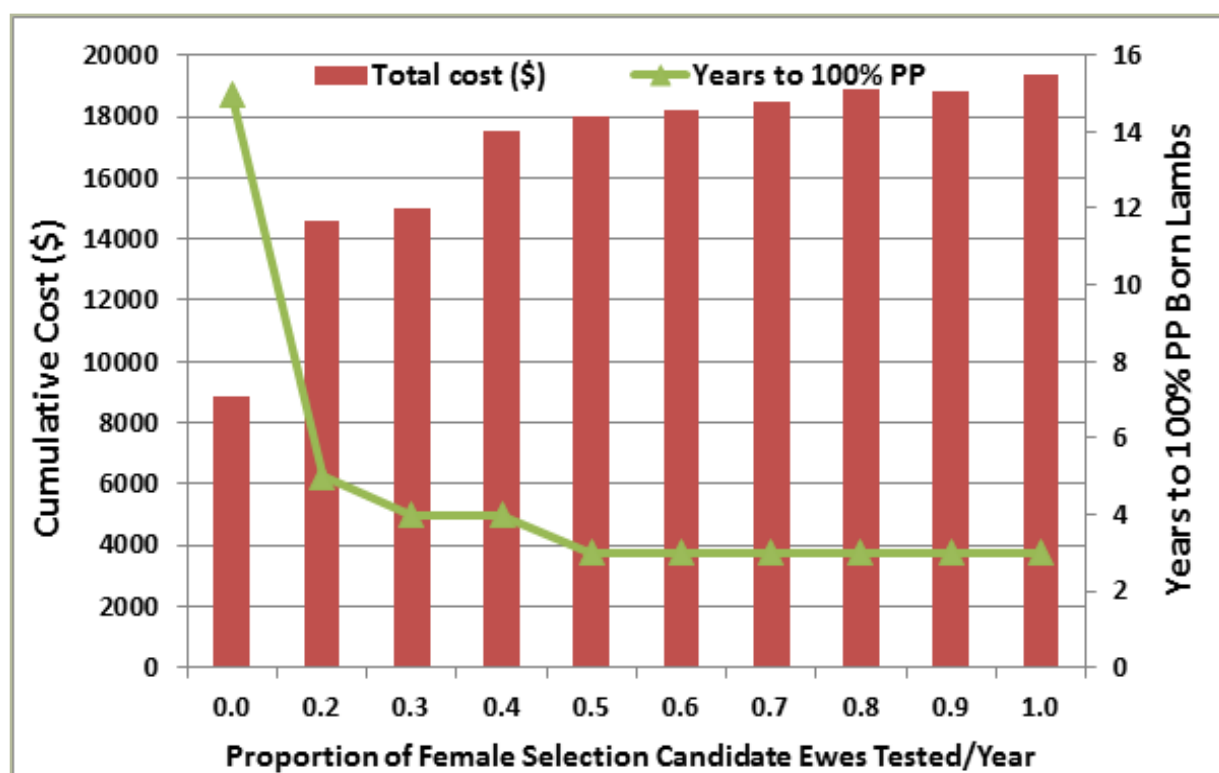


Figure 1: Cumulative cost of P/H testing ewe and ram selection candidates (left y-axis) and year to 100% PP born lambs (right y-axis) in scenarios where different proportions of ewe selection candidates can be tested.

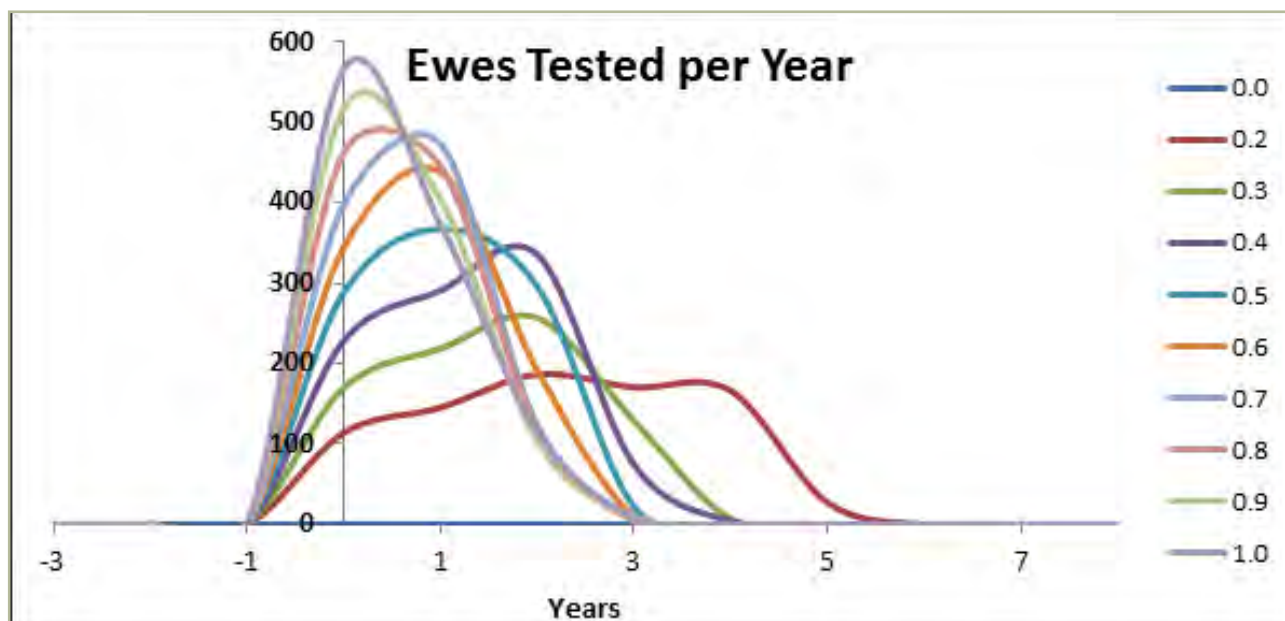


Figure 2: Distribution of number of ewe selection candidates tested for P/H with testing starting at year zero where different proportions of ewe selection candidates can be tested.

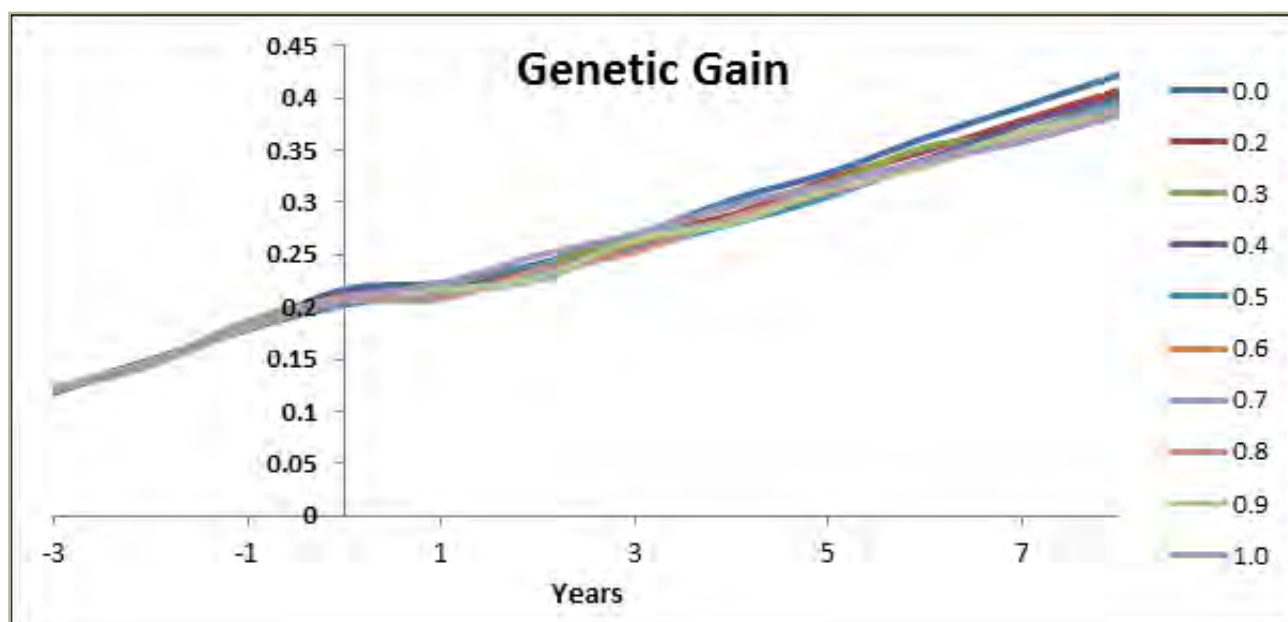


Figure 3: Genetic merit of each year's drop of lambs with testing for P/H starting at year zero where different proportions of ewe selection candidates can be tested.

Take home messages

- The fastest way for Merinotech's nucleus to reach 100% known PP was 3 years
- Testing higher proportions of ewe selection candidates has a larger up-front cost, whereas testing less costs slightly less and spreads cost more evenly over years

Advice followed

Merinotech has budgeted in 2015 to test all female selection candidates with the hope they may reach PP in 2 years. They plan to save costs by implanting embryos in HH and PH ewes. The Sheep CRC will follow their progress over the next few years enthusiastically.

More information

Sheep CRC website: www.sheepcrc.org.au, then choose Genotyping tests.

Sheep CRC Practical Wisdom notes:

- Genomics and DNA testing: new tools for ram breeders to accelerate genetic gain
- Sheep CRC genomic test for Merinos—what are the benefits?
- Sheep CRC genomic test for maternal breeds—what are the benefits?
- Sheep CRC genomic test for terminal breeds—what are the benefits?

The parentage and poll tests developed by the Sheep CRC is the result of the inputs of many collaborators, with inputs in first instance from MLA and researchers from CSIRO, the International Sheep Genomic Consortium (ISGC) and UNE and the staff at the INF sites at Cowra and Trangie (NSW DPI) Armidale (UNE), Rutherglen and Hamilton (Victoria DEPI), Struan and Turretfield (SARDI) and Katanning (DAFWA).