

Lifetime Wool - Effects of Nutrition during Pregnancy and Lactation on the Growth and Wool Production of their Progeny at Hogget Shearing

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ABSTRACT

The 'Lifetime Wool' project imposed a range of nutritional treatments on ewes during pregnancy and lactation that mimicked typical variations in nutrient supply experienced between years and regions. A similar experimental design was used at sites in WA and VIC in 2001 and 2002. At both sites ewes were at mean condition score ~ 2.5 at artificial insemination in February/March and then randomly allocated to two flocks and differentially fed to achieve a condition score of ~ 2.0 or ~ 3.0 by Day 90 - 100 of pregnancy. Within each condition score flock at Day 90, they were then allocated to pastures maintained at five different levels of feed on offer until lambs were weaned (design = 2 CS x 5 FOO = 10 plots x 2 or 3 replicates of 20-30 pregnant ewes). After weaning in November at both sites, all progeny were grazed together at the standard commercial stocking rate. The CFW and mean FD were measured at hogget shearing.

The treatments resulted in changes to clean fleece weight and fibre diameter of their progeny that appear to be dose responsive to maternal nutrition. In general clean fleece weight increased and the mean fibre diameter decreased as the level of feed-on-offer during late pregnancy and lactation increased. However, the linear response for clean fleece weight was only significant in WA (0.09 kg of clean fleece/500 kg of feed-on-offer; $p = 0.003$) and the linear decrease in fibre diameter was only significant in the combined progeny from both years in VIC (-0.09 $\mu\text{m}/500$ kg feed-on-offer; $p < 0.001$). These responses at the extreme treatments are greater than previously reported in the literature and had a significant impact on the outcome from whole-farm modeling of the economic consequences of the various feeding systems.

AIMS

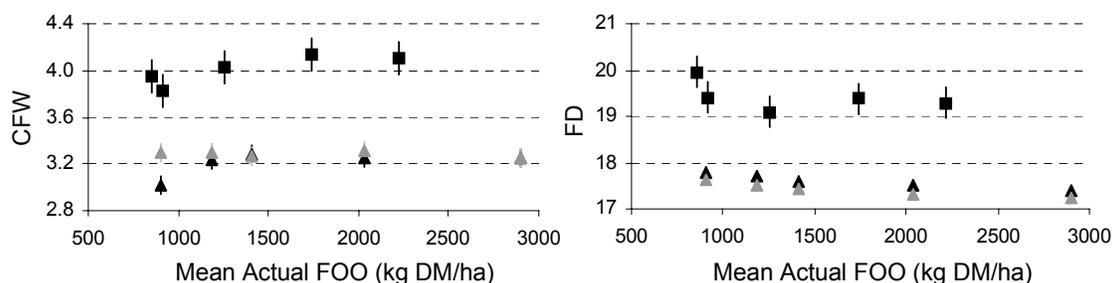
Gross changes in nutrient supply during critical stages of embryonic, fetal and early post-natal development can cause modifications in growth and development that, in turn, program adult performance. For instance, it has been documented that restricting nutrition of ewes during pregnancy can result in permanent changes to the clean fleece weight (CFW) and mean fibre diameter (FD) of progeny (Kelly *et al.* 1996). However, there is no published information on how these commercially important characteristics vary in progeny under more typical variations of nutrient supply to their mothers. This experiment tested the hypothesis that wool characteristics of the progeny would respond in a dose responsive way to changes in the nutrition of their mothers.

METHOD

Over 2 years (2001 and 2002) at two sites; Hamilton, Victoria (VIC) and Kendenup, Western Australia (WA), ewes were in mean condition score 2.5 (CS; Russell *et al.* 1969) at artificial insemination and then differentially fed to achieve a CS of ~ 2.0 or 3.0 by Day ~ 90 of pregnancy. Within each CS flock at Day 90, they were then allocated to pastures maintained at five different levels of feed on offer (FOO; Hyder *et al.* 2004) until lambs were weaned (design = 2 CS x 5 FOO = 10 plots x 2 (WA) or 3 (VIC) replicates of 20-30 pregnant ewes). The progeny were weaned off the plots at pasture senescence and run together under commercial grazing conditions. In VIC in both years the progeny were shorn as lambs and then as hoggets at 17 months with 12 months wool. In WA the progeny were first shorn at 9 months and then again at 21 months with 11 months wool. At the first adult shearing the greasy fleeces of all progeny were weighed and standard midside samples were measured for yield and mean fibre diameter. The CFW and mean FD was measured at hogget shearing (17 to 21 months). Linear mixed models were fitted to the CFW and FD data with random effects of rep and plot and fixed effects of FOO, CS, year, rear type, birthweight, age, sex and ram source and significant two-way interactions.

RESULTS

The experiments were successful in generating a large range of CS profiles for the ewes during pregnancy and lactation at both sites (Ferguson *et al.* 2004). The WA progeny were ~13 kg heavier than the VIC progeny at their hogget shearing and consequently cut more wool that was broader (Figure 1). At shearing there were still significant differences in liveweight of progeny between extreme treatments due to maternal nutrition (VIC: 1.5 ± 0.4 kg; $p = 0.006$ and WA: 3.2 ± 1.4 kg; $p = 0.01$). The VIC progeny from CS 3 mothers cut significantly more wool ($+ 0.08$ kg ± 0.031 ; $p = 0.02$) that was finer ($- 0.17 \pm 0.07 \mu\text{m}$; $p = 0.018$), than progeny from the CS 2 mothers, however there was no difference between CS treatment groups in the WA progeny (Figure 1). Nutrition during late pregnancy (FOO) had a significant positive linear effect on CFW at the WA site (0.09 kg/500 kg FOO; $p = 0.003$), but had no significant effect at the VIC site ($p = 0.32$). Alternatively, FOO had a negative effect on FD ($- 0.09 \mu\text{m}/500$ kg FOO; $p < 0.001$) at



the VIC site, and although a similar pattern was evident in WA it was not significant ($p = 0.32$).

Figure 1. The predicted treatment means \pm SE for clean fleece weight (CFW; kg) and fibre diameter (FD; μm) of the progeny in VIC (2001&2002 combined in CS 2 (▲) or CS3 (▲) at Day ~ 90) and WA (2001 CS 2 & 3 combined; ■), plotted against mean actual FOO (kg DM/ha) during late pregnancy and lactation.

CONCLUSION

Restricting the nutrition of ewes during pregnancy and lactation has resulted in significant changes to the wool production of the progeny, supporting the previous findings of Kelly *et al.* (1996) and strongly suggest that they are dose responsive. These responses at the extreme treatments are greater than previously reported in the literature and had a significant impact on the outcome from whole-farm modeling of the economic consequences of the various feeding systems (Young *et al.* 2004).

KEY WORDS

Ewe nutrition, condition score, progeny wool production, fibre diameter, clean fleece weight.

ACKNOWLEDGMENTS

The Lifetime Wool project was initiated as a cooperative project between the Department of Primary Industries, Victoria and the Department of Agriculture of Western Australia. Since, 2001 it has become a National project funded by Australian Wool Innovation Limited with on-farm experimental sites in all the main wool producing states.

Paper reviewed by: Johan Greeff

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