

The influence of genetics, animal age and nutrition on lamb production – an integrated research program

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Abstract. This paper provides an introduction to this Special Issue of the *Australian Journal of Experimental Agriculture*. The special issue is dedicated to an integrated research program that was intended to increase the understanding of the effects of breed and genetic selection for live animal traits (growth, muscle and fatness) on carcass and meat attributes. Combined with this are the effects of animal age and nutritional restriction at critical weaning points. The reasons for, and general approach, of the research are outlined.

Introduction

The Australian lamb industry has made impressive gains in efficiency through producing larger and leaner carcasses. These gains have been driven by genetic improvement flowing from LAMBPLAN and more recently Sheep Genetics Australia (Pethick *et al.* 2006). The lamb industry, through research commissioned by Meat and Livestock Australia, has also invested in meat quality research to underpin eating quality of the product (Russell *et al.* 2005). This coordinated approach represents the work of a dynamic industry focussed on the value chain and, most importantly, consumers.

To further underpin the progress made by genetic improvement and eating quality systems, the Australian Sheep Industry Cooperative Research Centre (Sheep CRC) undertook research to understand the influence of carcass breeding values and nutritional supply on carcass and eating quality (Hegarty *et al.* 2006). This work highlighted clear supply chain benefits in using terminal sires with high breeding values for early life growth and muscling potential. The important role of nutrition in capturing the genetic potential for growth was also a clear outcome. In addition, the powerful effects of the muscle breeding value (which delivers a higher muscle:bone ratio in carcasses) on nutrient partitioning and structure and biochemistry of muscle were elucidated. This work was extensive and thorough; however, it was restricted to one breed type and to one slaughter age point.

With the continued interest in lamb and sheep meat within Australia, there is now an increased supply of lambs derived from pure and half-cross Merino breeds. The Merino breed has typically been selected for wool production and is known to grow and mature more slowly, and so will reach market weights at an older age. Given this, one of the experiments reported on in this Special Issue has been designed to test the influence of slaughter age and breed responses on meat quality (Hopkins

et al. 2007a). The breeds, with defined breeding values for growth, muscle and fatness (with strongest genetic emphasis shown as a subscript), included Poll Dorset_{growth} × Border Leicester Merino, Poll Dorset_{growth} × Merino, Poll Dorset_{muscling} × Merino, Merino × Merino and Border Leicester × Merino. A total of 595 slaughter progeny were compared at 4, 8, 14 and 22 months of age which allowed comparisons from unweaned (or sucker) lambs to hoggets. These contrasts have been used to understand the wider genetic and age effects on carcass quality, eating quality, muscle structure and biochemistry, bone growth and aspects of fat composition.

An additional issue raised by commercial prime lamb producers was the importance of understanding the influence of growth checks in young lambs on subsequent growth, carcass and eating quality performance. Lamb producers were asking if genetic potential could be lost by growth checks at weaning and also if carcasses would become fatter as lambs reached target slaughter weights. Therefore a second experiment was designed to investigate the effects of weaning weight (and so age), and growth restriction at this time (Hopkins *et al.* 2007b). This experiment was based on 627 Poll Dorset × Merino lambs sired by four classes of sire groups selected to show extremes for breeding values of growth and muscle. The nutritional overlay was two weaning weights (20 kg or 30 kg) and two growth paths (restriction for 55 days v. continuous growth) with slaughter at ~21 kg hot carcass weight.

The papers included in this Special Issue of the *Australian Journal of Experimental Agriculture* and the two experiments that yielded the data are based on large and carefully designed experiments that any one research group would find difficult to undertake. As cited by Purchas (2007), the work covered and the power of the research output are a credit to the Australian Government's Cooperative Research Centre scheme and to the

Sheep CRC in particular. It provides an illustration of the way in which scientists with a wide range of skills and from a range of different institutions can be brought together to work effectively on common experiments when a framework that facilitates and encourages such collaboration is in place. An additional bonus in Australia is a strong research culture within the lamb and sheep meat industry which is also crucial to (i) support the research and (ii) adopt the results to drive consumer demand and industry profitability.

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