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**The effects of genes/QTL for muscle and fat on the
weights of saleable carcass components in sheep**

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Abstract

Sheep farmers in New Zealand have the opportunity to increase income through selection based on genetic markers linked to Quantitative Trait Loci (QTL) and/or genes for a variety of traits. A small number of muscle-related QTL/genes have been discovered in sheep and include the Callipyge gene, myostatin gene and the LoinMAX™ QTL. All of these QTL/genes result in an increase in the proportion of lean meat that is produced by the lamb; the size of the increase is different between the QTL/genes. The LoinMAX™ QTL has the smallest effect on carcass composition and results in an increase in the weight and area of the eye muscle. The Callipyge gene shows a larger change in carcass composition than the LoinMAX™ QTL, resulting in a visible increase in the muscles in the hind quarter of the sheep. The myostatin gene has a more general effect on the carcass of a sheep and results in an increase in the weight of all the muscles of the carcass and a decrease in the fat content of the carcass. Both the Callipyge and the myostatin gene also result in an increase in the dressing out percentage of the animal. There is limited information on the economic effects of introducing such QTL/genes into sheep populations.

This study involved using a modelling approach to examine the impact of muscle and dressing out percentage QTL in a sheep flock. A model was established to simulate the growth of 1000 lambs from weaning to slaughter. Further models were used to simulate the processing of carcasses into cuts, with the value of the carcass estimated for both processors and farmers, based on the weight of the individual cuts. A base scenario established the size of cuts and carcass value for lambs, without the presence of known QTL/genes. Four experimental scenarios were examined based on the Callipyge gene, the myostatin gene, the LoinMAX™ QTL, and the effects of the Callipyge and myostatin gene on dressing out percentage. Within each scenario, the QTL effect was estimated at four different magnitudes. The model output for each of the QTL effects was compared to the base model to estimate the additional income of the meat processor when purchasing lambs from farmers who had used the QTL/gene and also the additional income to the farmers.

This study found that the use of muscle QTL/genes in a New Zealand flock has variable effects on the income generated for the processor and the farmer. All the QTL/genes in the study, which were loosely based on muscle QTL/genes currently identified in sheep, resulted in an increase in income for both farmers and processors. The scenario that was based on the LoinMAX™ QTL generated an additional \$0.80 to \$1.80 per lamb for the processor and an additional \$0.56 to \$1.26 per lamb for the farmer. The effect of the Callipyge gene resulted in an increase in the income generated for the processor of between \$12.59 and \$14.97 per lamb, and between \$8.81 and \$10.48 per lamb for the farmer. The last of the muscle QTL/genes analysed was the myostatin gene, the use of this gene in a commercial flock resulted in between \$4.19 and \$7.99 per lamb additional income for the processor and between \$2.93 and \$5.59 per lamb for the processor. When the effect of a dressing out percentage QTL was run through the model the additional income generated for the processor, when the QTL effect was between 5% and 10%, was within \$3.56 and \$8.11 and the additional income for farmers was between \$2.49 and \$5.68.

It can be concluded from this study that the size of the QTL/gene effect and the muscles that are affected by the QTL/gene will influence the additional income that can be generated for the farmer and the processor. In general additional income can be achieved; however, whether or not this outweighs any additional costs that may be associated with using such QTL/genes needs further investigation.

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