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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.
# INTRODUCTION

## REVIEW OF LITERATURE

### 2.1 INTRODUCTION

### 2.2 SELECTION OF ANIMALS IN LIVESTOCK PRODUCTION SYSTEMS

#### 2.2.1 CURRENT METHODS OF SELECTING LIVESTOCK

#### 2.2.2 QUANTITATIVE-TRAIT LOCI DISCOVERED IN LIVESTOCK SPECIES

#### 2.2.3 DNA MARKERS USED TO SELECT FOR QTL

#### 2.2.3.1 Linkage Equilibrium Between Markers and QTL

#### 2.2.3.2 Linkage Disequilibrium Between Markers and QTL

#### 2.2.4 USE OF MARKERS TO SELECT FOR BREEDING ANIMALS

#### 2.2.4.1 Current Industry Examples of QTL

#### 2.2.5 EFFECT OF USING MARKERS THAT HAVE BEEN INCORRECTLY IDENTIFIED TO SELECT ANIMALS

### 2.3 THE EFFECT OF THE QTL ON THE PHENOTYPE OF THE ANIMAL

#### 2.3.1 LOINMAX™ QTL

#### 2.3.2 CALLIPYGE GENE

#### 2.3.3 MYOSTATIN GENE

### 2.4 SHEEP FARMING IN NEW ZEALAND

#### 2.4.1 IMPORTANCE OF SHEEP FARMING TO THE ECONOMY OF NEW ZEALAND

#### 2.4.2 ASPECTS BEHIND PRODUCTION OF LAMBS ON NEW ZEALAND FARMS

#### 2.4.3 LAMB PRODUCTION SYSTEMS ON NEW ZEALAND FARMS

#### 2.4.4 ASPECTS BEHIND PROCESSING OF LAMBS SENT TO SLAUGHTER

### 2.5 PAYMENT METHODS FOR NEW ZEALAND LAMB

#### 2.5.1 PAST PAYMENT METHOD

#### 2.5.2 CURRENT PAYMENT METHOD

#### 2.5.3 FUTURE PAYMENT METHODS

#### 2.5.3.1 Payment based on the weight of individual cuts

#### 2.5.3.2 Payment based on image scanning methods

### 2.6 ANATOMY OF THE SHEEP AND CARCASS CUTS

### 2.7 DEVELOPMENT OF COMPUTER MODELS

### 2.8 LITERATURE REVIEW SUMMARY

## MATERIALS AND METHODS

### 3.1 COMMERCIAL SECTOR

### 3.2 PROCESSOR

### 3.3 DATABASE GENERATION

### 3.4 SCENARIOS TO BE EXAMINED

#### 3.4.1 LOINMAX™ QTL

#### 3.4.2 CALLIPYGE GENE

#### 3.4.3 MYOSTATIN GENE

#### 3.4.4 DRESSING OUT PERCENTAGE QTL

### 3.5 COMPARISON OF BASE MODEL TO QTL/GENE EFFECTS

## RESULTS

### 4.1 BASE MODEL

#### 4.1.1 MODEL VALIDATION

#### 4.1.2 PAYMENT TO FARMERS BASED ON CARCASS WEIGHT AND GR
4.2 LOIN MAX™ QTL
4.2.1 LOIN MAX™ QTL WITH A 5% EFFECT
4.2.2 LOIN MAX™ QTL WITH A 10% EFFECT
4.2.3 LOIN MAX™ QTL WITH A 15% EFFECT
4.2.4 LOIN MAX™ QTL WITH A 20% EFFECT

4.3 CALLIPYGE GENE
4.3.1 CALLIPYGE GENE WITH A 15% EFFECT
4.3.2 CALLIPYGE GENE WITH A 20% EFFECT
4.3.3 CALLIPYGE GENE WITH A 25% EFFECT
4.3.4 CALLIPYGE GENE WITH A 30% EFFECT

4.4 MYOSTATIN GENE
4.4.1 MYOSTATIN GENE WITH A 5% EFFECT
4.4.2 MYOSTATIN GENE WITH A 10% EFFECT
4.4.3 MYOSTATIN GENE WITH A 15% EFFECT
4.4.4 MYOSTATIN GENE WITH A 20% EFFECT

4.5 DRESSING OUT PERCENTAGE QTL
4.5.1 DRESSING OUT PERCENTAGE QTL WITH A 5% EFFECT
4.5.2 DRESSING OUT PERCENTAGE QTL WITH A 10% EFFECT
4.5.3 DRESSING OUT PERCENTAGE QTL WITH A 15% EFFECT
4.5.4 DRESSING OUT PERCENTAGE QTL WITH A 20% EFFECT

5 DISCUSSION
5.1 LOIN MAX™ QTL
5.1.1 PROCESSOR
5.1.2 FARMER
5.2 CALLIPYGE GENE
5.2.1 PROCESSOR
5.2.2 FARMERS
5.3 MYOSTATIN GENE
5.3.1 PROCESSOR
5.3.2 FARMER
5.4 DRESSING OUT PERCENTAGE QTL
5.4.1 PROCESSOR
5.4.2 FARMER
5.5 GENERAL DISCUSSION
5.6 LIMITATIONS OF THE STUDY

6 CONCLUSION

7 REFERENCE LIST

8 APPENDIX ONE: CALCULATIONS TO DETERMINE YIELD PROPORTIONS FOR EACH OF THE SCENARIOS INVESTIGATED.
List of Tables

Table 2.1: Value of New Zealand Exports*(Modified from Meat and Wool New Zealand 2003-04 Annual Report) .............................................................. 19
Table 2.2: The adjustments that are made to dressing percentages for time off feed before final weight is made (Flyn, ) ............................................................... 24
Table 2.3: Composition of the cuts generated by Richmonds Ltd and used in this study .......... 31
Table 3.1: Lamb and Mutton Prices for P Grade Carcasses: Commencing 02/02/03 Richmonds Schedule No. 19 ................................................................. 38
Table 3.2: Description of carcass parts used in the model, values of the cuts($/kg), and raw means and standard deviations(kg)(Johnson et al., 2002) ........................................... 39
Table 3.3: Generation of yield proportions using cut weights and standard deviations from a Romney population .............................................................. 41
Table 3.4: Worked example of generating cut weights for a 17kg carcass .................................. 42
Table 3.5: Yield proportions for the base model, Loin Max™ 5%, Loin Max™ 10%, Loin Max™ 15%, and Loin Max™ 20%. There is a 5%, 10%, 15%, and 20%, increase in the frenched rack and strip loin for Scenario One to Four respectively ...................................... 45
Table 3.6: Yield proportions for the base model, Callipyge 15%, Callipyge 20%, Callipyge 25%, and Callipyge 30%. There is a 15%, 20%, 25%, and 30%, increase in the boneless leg, frenched rack, strip loin, and fillet for Scenario Five to Eight respectively ........................................ 46
Table 3.7: Yield proportions for the base model, Myostatin 10%, Myostatin 15%, Myostatin 20%, Myostatin 25%. There is a 10%, 15%, 20%, and 25%, increase in the frenched rack and strip loin ................................................................. 47
Table 4.1: Comparison of the five runs of the base model to validate the model ..................... 49
Table 4.2: Base model: comparison of the income generated for farmers when paid on carcass weight and the income generated for processors paid on cut size .................................. 50
Table 4.3: The average value received by a processor per lamb and for individual cuts for ram lambs. Lambs were drafted at 40 kg liveweight and cut down into individual cuts ................................................................. 50
Table 4.4: The average value received by a processor per lamb and for individual cuts for ewe lambs. Lambs were drafted at 35 kg liveweight and cut down into individual cuts ................................................................. 51
Table 4.5: The number slaughtered, liveweights and carcass weights of rams and ewes, and per lamb value paid to the processor for four draft dates and overall when the Loin Max™ QTL has a 5% effect ........................................ 52
Table 4.6: The average value received by the processor per lamb and for individual cuts in the base model and when the Loin Max™ QTL has a 5% effect and the difference (D) in per-lamb value and cut values between the two scenarios ................................................................. 53
Table 4.7: The number slaughtered, liveweights and carcass weights of rams and ewes, and per lamb value paid to the processor for four draft dates and overall when the Loin Max™ QTL has a 10% effect ................................................................. 53
Table 4.8: The average value received by the processor per lamb and for individual cuts in the base model and when the Loin Max™ QTL has a 10% effect and the difference (D) in per-lamb value and cut values between the two scenarios ................................................................. 54
Table 4.9: The number slaughtered, liveweights and carcass weights of rams and ewes, and per lamb value paid to the processor for four draft dates and overall when the Loin Max™ QTL has a 15% effect ................................................................. 54
Table 4.10: The average value received by the processor per lamb and for individual cuts in the base model and when the Loin Max™ QTL has a 15% effect and the difference (D) in per-lamb value and cut values between the two systems ................................................................. 55
Table 4.11: The number slaughtered, liveweights and carcass weights of rams and ewes, and per lamb value paid to the processor for four draft dates and overall when the Loin Max™ QTL has a 20% effect ................................................................. 55
Table 4.12: The average value received by the processor per lamb and for individual cuts in the base model and when the Loin Max™ QTL has a 20% effect and the difference (D) in per-lamb value and cut values between the two scenarios ................................................................. 56
Table 4.13: The number of lambs slaughtered, liveweights and carcass weights of rams and ewes, and the per-lamb value paid to the processor for four draft dates and overall when the Callipyge gene has a 15% effect ................................................................. 57
Table 4.14: The average value received by the processor per lamb, and for individual cuts in the base model and when the Callipyge gene has a 15% effect and the difference (D) between the per-lamb value and cut values between the two scenarios. .............................. 58
Table 4.15: The number of lambs slaughtered, liveweights and carcass weights of rams and ewes, and the per-lamb value paid to the processor for four draft dates and overall when the Callipyge gene has a 20% effect. .................................................. 58
Table 4.16: The average value received by the processor per lamb, and for individual cuts in the base model and when the Callipyge gene has a 20% effect, and the difference (D) between the per-lamb value and cut values between the two scenarios. ........................................... 59
Table 4.17: The number of lambs slaughtered, liveweights and carcass weights of rams and ewes, and the per-lamb value paid to the processor for four draft dates and overall when the Callipyge gene has a 25% effect. .................................................. 59
Table 4.18: The average value received by the processor per lamb, and for individual cuts in the base model and when the Callipyge gene has a 20% effect, and the difference (D) between the per-lamb value and cut values between the two scenarios. ........................................... 60
Table 4.19: The number of lambs slaughtered, liveweights and carcass weights of rams and ewes, and the per-lamb value paid to the processor for four draft dates and overall when the Callipyge gene has a 25% effect. .................................................. 60
Table 4.20: The average value received by the processor per lamb, and for individual cuts in the base model and when the Callipyge gene has a 30% effect, and the difference (D) between the per-lamb value and cut values between the two systems. ........................................... 61
Table 4.21: The number of lambs slaughtered, liveweights and carcass weights of rams and ewes, and the per-lamb value paid to the processor for four draft dates and overall when the Callipyge gene has a 30% effect. .................................................. 61
Table 4.22: The average value received by the processor per lamb, and for individual cuts in the base model and when the Callipyge gene has a 30% effect and the difference (D) between the per-lamb value and cut values between the two systems. ........................................... 62
Table 4.23: The number of lambs slaughtered, liveweights and carcass weights of rams and ewes, and the per-lamb value paid to the processor for four draft dates and overall when the Callipyge gene has a 30% effect. .................................................. 62
Table 4.24: The average value received by the processor per lamb, and for individual cuts in the base model and when the Callipyge gene has a 30% effect and the difference (D) between the per-lamb value and cut values between the two systems. ........................................... 63
Table 4.25: The number of lambs slaughtered, liveweights and carcass weights of rams and ewes, and the per-lamb value paid to the processor for four draft dates and overall when the Callipyge gene has a 30% effect. .................................................. 63
Table 4.26: The average value received by the processor per lamb, and for individual cuts in the base model and when the Callipyge gene has a 30% effect and the difference (D) between the per-lamb value and cut values between the two systems. ........................................... 64
Table 4.27: The number of lambs slaughtered, liveweights and carcass weights of rams and ewes, and the per-lamb value paid to the processor for four draft dates and overall when the Callipyge gene has a 30% effect. .................................................. 64
Table 4.28: The average value received by the processor per lamb, and for individual cuts in the base model and when the Callipyge gene has a 30% effect and the difference (D) between the per-lamb value and cut values between the two systems. ........................................... 65
Table 4.29: The number of lambs slaughtered, liveweights and carcass weights of rams and ewes, and the per-lamb value paid to the processor for four draft dates and overall when the Callipyge gene has a 30% effect. .................................................. 65
Table 4.30: The average value received by the processor per lamb, and for individual cuts in the base model and when the Callipyge gene has a 30% effect and the difference (D) between the per-lamb value and cut values between the two systems. ........................................... 66
Table 4.31: The number of lambs slaughtered, liveweights and carcass weights of rams and ewes, and the per-lamb value paid to the processor for four draft dates and overall when the Callipyge gene has a 30% effect. .................................................. 66
Table 4.32: The average value received by the processor per lamb, and for individual cuts in the base model and when the dressing out percentage QTL has a 10% effect and the difference (D) between the per-lamb value and cut values between the two systems. ........................................... 67
Table 4.33: The number of lambs slaughtered, liveweights and carcass weights of rams and ewes, and the per-lamb value paid to the processor for four draft dates and overall when the dressing out percentage QTL has a 10% effect. .................................................. 67
Table 4.34: The average value received by the processor per lamb, and for individual cuts in the base model and when the dressing out percentage QTL has a 10% effect and the difference (D) between the per-lamb value and cut values between the two systems. ........................................... 68
Table 4.35: The number of lambs slaughtered, liveweights and carcass weights of rams and ewes, and the per-lamb value paid to the processor for four draft dates and overall when the dressing out percentage QTL has a 10% effect. .................................................. 68
Table 4.36: The average value received by the processor per lamb, and for individual cuts in the base model and when the dressing out percentage QTL has a 10% effect and the difference (D) between the per-lamb value and cut values between the two systems. ........................................... 69
Table 4.37: The number of lambs slaughtered, liveweights and carcass weights of rams and ewes, and the per-lamb value paid to the processor for four draft dates and overall when the dressing out percentage QTL has a 10% effect. .................................................. 69
Table 4.34: The average value received by the processor per lamb, and for individual cuts in the base model and when the dressing out percentage QTL has a 15% effect and the difference (D) between the per-lamb value and cut values between the two systems. .......................... 70
Table 4.35: The number of lambs slaughtered, liveweights and carcass weights of rams and ewes, and the per-lamb value paid to the processor for four draft dates and overall when the dressing out percentage QTL has a 20% effect. ................................................................. 70
Table 4.36: The average value received by the processor per lamb, and for individual cuts in the base model and when the dressing out percentage QTL has a 20% effect and the difference (D) between the per-lamb value and cut values between the two systems. .......................... 70
Table 5.1: Comparison of the base model with Loin Max™ 5%, 10%, 15% and 20% .................. 71
Table 5.2: Price paid to the farmer and the difference (D) compared to the base model when they are paid at 65, 70 and 75% of the value received by the processor ..................................................... 73
Table 5.3: Comparison of the base model with Callipyge 15%, 20%, 25% and 30% ............... 75
Table 5.4: Price paid to the farmer when they are paid at 65, 70 and 75% of the value received by the processor .................................................................................................................................................................................. 76
Table 5.5: Comparison of the base model with Myostatin 5%, 10%, 15% and 20% .......... 77
Table 5.6: Price paid to the farmer when they are paid at 65, 70 and 75% of the value received by the processor .................................................................................................................................................................................. 78
Table 5.7: Comparison of the base model with a dressing out percentage QTL of 5%, 10%, 15% and 20%. .................................................................................................................................................................................. 79
Table 5.8: Price paid to the farmer when they are paid at 65, 70 and 75% of the value received by the processor .................................................................................................................................................................................. 80
List of Figures

Figure 2.1: The effect of selection on domestic sheep (Anonymous, 1998) ........................................ 3
Figure 2.2: Comparison of sheep and beef prices paid to farmers in from the 1992-93 season to the 2003-04 season. ................................................................. 20
Figure 2.3: Prices paid to the farmer per kilogram of carcass weight over the past ten years ................................................................. 26
Figure 2.4: The divisions of the lamb carcass that would be generated when the lambs are processed (Lirette et al., 1984). ................................................................. 30
Figure 3.1: Flow diagram of the commercial sector that shows the progression of the lambs from weaning until they are sent to the processor ................................................................. 36
Figure 3.2: Flow diagram showing the income generated for the processor when the lambs are sent to slaughter. ................................................................. 39
Figure 3.3: Flow diagram showing the development of the carcass weight and cut database for ewe lambs ................................................................. 40
Figure 3.4: Flow diagram showing the development of the carcass weight and cut database for ram lambs ................................................................. 41