

**A study of the carcass composition and meat quality of Southdown sheep selected for differences in backfat depth : a thesis presented in partial fulfilment of the requirements for the degree of Doctor of Philosophy in Animal Science at Massey University, Palmerston North, New Zealand**

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Southdown sheep from genetic lines that have been developed at Massey University by selecting for and against weight-corrected fat-depth measurements made ultrasonically on the live sheep, were evaluated for carcass and meat quality characteristics in 4 experiments, while their crossbred offspring from Romney ewes were evaluated in 2 experiments.

No significant differences were found in daily live-weight gains between the two selection lines, but the fat-line animals had greater fat depths at C and to a lesser extent at J, S2, LG and L2. Tissue depth GR was also significantly greater in the fat line. Comparisons at the same weight showed that sides from the meaty line contained more muscle and bone with less fat than those from the fat line, but the meaty-line carcasses had a relatively lower dressing-out percent. Carcass length was significantly longer for the meaty-line than the fat-line animals, but the maximum width behind the shoulder was greater for the fat line. The length of leg and several bones (femur, humerus, radius, and tibia and fibula) were greater for the meaty line than the fat line. With the exception of the higher rack cut percent in the fat line, the two selection lines did not differ in the weight distribution among the shoulder, loin, and leg cuts within the side, or in the distribution of muscle, bone and fat weights. When adjusted to the same side fat weight, the side from the fat line contained more subcutaneous fat, more intramuscular fat, and less intermuscular fat.

Based on succinic dehydrogenase staining procedures, *M. semitendinosus* from the fat line was found to have a significantly higher percent of red muscle fibre ( $\beta R$ ) and a correspondingly lower percent of intermediate ( $\alpha R$ ) and white muscle fibre ( $\alpha W$ ). No significant line differences were observed for the diameter of the three muscle-fibre types. For five adipose tissue depots (subcutaneous, intermuscular, kidney, omental and mesenteric) adipocyte size was greater for the fat line. In addition, the subcutaneous fat depot of fat-line sheep contained significantly more cells in one of the three experiments.

Equations relating side fat percent with fat percent of the rack cut (8 to 12 rib) differed significantly between the two lines with regard to intercept. This effect appeared to be due to the small overlap in fat percent values for the two lines. Selection line differences in indices of meat quality (Warner-Bratzler shear force, sarcomere length, reflectance, expressed juice, cooking loss and pH) for four muscles (*Mm. longissimus*, biceps femoris, semitendinosus, semimembranosus) were generally small and non-significant. Meat from animals of the two selection lines did not differ significantly in the extent to which shear values decreased in response to electrical stimulation, to ageing for 15 days (*M. semimembranosus*), to the removal of cold-shortening conditions (*M. biceps femoris*), or to not trimming the subcutaneous fat over the *M. longissimus*. However, the shear force values and sarcomere lengths from both lines were significantly affected by all of these post-mortem treatments.

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