GENETIC TRENDS IN THE NEW ZEALAND TEXEL

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SUMMARY
The Texel breed of sheep was imported into New Zealand in the mid-1980’s. From their commercial release in 1990 until 1995/96 breeders were in an expansion phase, principally aiming to increase animal numbers with little selection pressure placed on replacements. In 1998, 18 breeders combined to form the New Zealand Texel Sire Referencing Programme. Previously recorded data from these properties were analysed to generate breeding values and genetic trends. The majority of the flocks are making progress in carcass lean weight, although only four are achieving gains close to the predicted rates possible. Only one of the 18 flocks has made genetic progress in both increasing carcass lean weight and decreasing carcass fat weight since 1996. The introduction of the sire referencing programme has come at a crucial time for the breed. Through setting a common breeding objective, and enhanced ability to identify and select the best sires Texel breeders should be able to increase their rate of genetic gain and move towards being the ideal terminal sire breed.

Keywords: Texel, sheep, genetic improvement, Computed Tomography, meat.

INTRODUCTION
Discussions within the sheep industry in the 1970’s and early 1980’s concluded that a new terminal sire breed was required in New Zealand, to help decrease carcass fat and increase carcass lean, whilst retaining acceptable carcass weights. The Texel breed stood out as meeting such criteria and was successfully introduced through two separate importations in 1985 and 1986 of Danish and Finnish strains. After five years in quarantine the first animals were released in 1990. From this foundation the number of registered Texel studs increased rapidly, peaking at 140 in 1996. Since then the number of studs has declined to 117 registered studs in 1999. This has been accompanied with a rise in the average number of stud ewes per flock put to the ram; 52 in 1996 compared with 101 in 1999.

Following their establishment, a number of studs routinely recorded liveweight gains and ultrasonic measurements of fat depth and eye muscle dimensions. Associated with this were breeding decisions emphasising selection based on increased liveweight gain and decreased ultrasonic fat depth with the aim of improving carcass weight and carcass quality. Subsequent to a successful pilot study in 1997, involving several North Island breeders, in 1998 a group of 18 stud Texel breeders collaborated to start the New Zealand Texel Sire Referencing Programme (NZTSRP), and since then two more studs have become involved. This scheme involves 3563 pure bred Texel ewes and 622 up grade ewes, which is more than 30% of the total registered Texel breed in New Zealand. The first matings of this scheme were undertaken in 1999, with three national link sires used. The purpose of the NZTSRP is to establish sound breeding objectives for Texels and improve the rate of genetic gain via effective use of Computed Tomography (CT) scanning and improved breeding scheme design.
The aim of the present work was to analyse the rate of genetic gain from 1987 to 1999 within the Texel breed using flocks in the NZTSRP. The results are compared against potential rates of genetic gain to assess which factors need to be taken into consideration by the NZTSRP if they are to meet the target rates of gain expected.

**MATERIAL AND METHODS**

Records were available for weaning weight (n=16,698), liveweight at six months (n=918), liveweight at eight months (n=16,393), and ultrasonic measurements of fat depth (n=16,127) and eye muscle width (n=16,091) and depth (n=16,643) coupled with a small number of Computer Tomography (CT) measurements (n=200). Fixed effects (birth and rearing rank, age of dam and date of birth) and contemporary groups (flock, birth year, sex and grazing mob) were formed and the raw measurements were scaled using SAS (1991). The analytical model used was an across-flock/sex/year multi-trait animal model accounting for the fixed effects of birth-rearing rank, age of dam and birth day, and random individual additive genetic effects (PEST; Groeneveld and Kovac 1992). Genetic parameters used were those described by Jopson et al. (1995).

Breeding Values (BVs), for 37,060 animals (of which 6819 were foundation parents), set to a mean of zero for 1988 animals, were estimated for ewe live weight, liveweight at eight months, liveweight at twelve months, liveweight at weaning, carcass weight, eye muscle depth, eye muscle width, eye muscle area, fat depth, carcass fat weight and carcass lean weight.

As the current objectives of the Texel breeders are to increase carcass lean weight and decrease carcass fat weight, these along with their predictors, (liveweight at eight months and ultrasonic fat depth) were further analysed. These data were averaged per flock per year to obtain genetic trend graphs for the flocks. The standard error of the mean was calculated for each flock-year combination using the breeding values which were considered not to have any individual variance.

The expected rates of genetic gain were determined using the genetic and phenotypic parameters described by Jopson et al. (1995). Selection intensity was estimated as 0.54 i/year, consistent with an average age of males of 2 years and dams of 3.5 years and with the best 3% of males and 50% of females retained for breeding. The economic values per kilogram increases in carcass lean and carcass fat were taken as $5.40 and -$3.00 respectively. These values were recently adopted by Texel breeders as the breed standard following a survey of their ram buying clients.

**RESULTS AND DISCUSSION**

Graphs generated for each flock show that following commercial release in 1990 and until 1996, there was no real genetic progress achieved in any of the 18 Texel studs. This time period corresponds with the period of rapid expansion of the breed indicated by the number of studs established during this time, with the main emphasis of breeders being to increase animal numbers. From 1996 as the number of studs declined, and mean flock sizes increased, the rate of genetic gain increased, particularly for liveweight and lean weight, although there was considerable variation amongst individual flocks.
The expected rates of genetic gain for the traits in the breeding objective of decreasing carcass fat and increasing carcass lean were –6g/year and 153g/year respectively using liveweight and ultrasound on all progeny and –71g/year and 220g/year respectively when CT was also utilised. Five flocks achieved the expected rate of genetic gain for carcass lean, but little or no decrease was made in carcass fat in these flocks, with the exception of one which had a history of CT use. Five flocks made greater than expected rates of gain for reduction of carcass fat. However, a typical genetic trend graph for carcass fat (Figure 1), shows that most of the variation between years is accounted for by the standard errors of the means. Two flocks actually exhibited a negative genetic trend for carcass lean, which was coupled with a greater than expected rate of genetic gain for carcass fat. The genetic trends for the only flock to have consistently achieved genetic gain in both traits in the objective since 1996 are illustrated in Figures 2 and 3 (including prior to 1996).

![Figure 1. Genetic trends for the objective trait of carcass fat weight and the predictor trait of ultrasonic fat depth, in a flock showing static genetic progress.](image1)

![Figure 2. Genetic trends for the objective trait of carcass lean and the predictor trait of liveweight at eight months, in a flock showing positive genetic progress.](image2)
Figure 3. Genetic trends for the objective trait of carcass fat weight and the predictor trait of ultrasonic fat depth, in a flock showing desirable genetic progress.

Good progress has generally been made for carcass lean and its predictor trait (liveweight at eight months; an easily recorded trait for which selection is straightforward). Some selection pressure has been applied for carcass fat since 1996 as it has been maintained in most flocks. Without this selection pressure, the high positive correlation with liveweight would have resulted in an increase in fat along with that in carcass lean. Despite this correlation, genetic gain can be made in both of the traits, i.e. to decrease carcass fat, not just maintain it. The most likely reason for the differences between breeder was the proportion of animals measured with ultrasound and CT, coupled with differing breeding objectives. Changing measurements and breeding objectives are however not the only ways to improve rates of genetic gain as they need to be coupled with greater selection intensity. This is achievable through better breeding scheme design and is one of the major benefits to be obtained from sire referencing, particularly when linking small terminal sire breed flocks.

The establishment of the NZTSRP has come at a critical time in the development of the Texel breed in New Zealand. By setting up a national selection programme and employing geneticists they are establishing common breeding objectives and sound breeding schemes through the use of Best Linear Unbiased Prediction (BLUP). Using superior linked sires across an increased number of ewes, combined with increased use of ultrasonic and CT scanning will lead to increased accuracy of selection (Jopson et al. 1995). Application of such measures will allow Texel breeders to achieve potential rates of genetic gain and improve profitability. The Texel is currently the only terminal sire breed in New Zealand to have a national sire referencing scheme, to have developed breed specific breeding objectives, and to record the same traits consistently across all flocks. In employing these initiatives they are placing themselves at the forefront of terminal sire breeders in New Zealand and applying a system to breed towards meeting the market requirements of heavier, leaner carcasses.

REFERENCES