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Information from New Zealand and Australian Merino Wether Trials

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Summary

Fleece production and bodyweight data are presented for the two Merino wether trials that have been run in New Zealand at Central Otago and Marlborough. Each trial consisted of 30 or more teams of 10 wethers of mixed bloodlines. The teams have been classified into four strains on the basis of fibre diameter.

The clean fleece weight: fibre diameter relationships are compared with and found to be similar to those obtained in wether trials run in New South Wales. For every 1 kg increase in clean fleece weight (due to genotypic or environmental effects), fibre diameter increased by 1.5 microns. Alternatively for every 10% increase in clean fleece weight percentage, fibre diameter deviation increased by 0.6 microns. The results suggest that fine wool strains are the most profitable to run in New Zealand, if the current premiums for fineness are maintained.

Introduction

Two wether production trials with 30 or more teams of 10 wethers have been run in New Zealand in the Central Otago (1984-88) and Marlborough (1985-89) regions.

The New Zealand wether trials unfortunately suffered from the two major problems of small team sizes and non-random team selection highlighted by Hygate and Atkins (1988a) in their study of New South Wales trials. A number of interesting observations can still be made from an analysis of the results, although an unknown bias exists when comparing the mean performance of different strains of Merino. Due to the mixture of Australian and New Zealand bloodlines in most New Zealand commercial flocks it is only possible to compare strains rather than individual bloodlines.

Methods

Records of greasy fleece weight (GFW), Yield (YD), Fibre Diameter (FD), Bodyweight (BW) and the derived traits clean fleece weight(CFW), clean fleece weight percentage (CFWP), greasy fleeceweight percentage (GFWP), bodyweight percentage (BWP), yield deviation (YLDD) and fibre diameter deviation (FDD) were analysed from the two New Zealand trials at Central Otago (O) and Marlborough (M) for each year of the two trials. CFWP, GFWP,BWP, YLDD and FDD were calculated for each sheep in relation to the average performance of all sheep for the relevant year and trial site. The teams have been allocated to a strain on the basis of the team's average FD over the first four years of the trial. Teams with an average FD less than 20 mm were classified:

- Fine (F), < 20 μm
- Medium (M), 20 - 21.5 μm
- Strong (S) 21.5 - 23.5 μm
- Extrastrong (XS) > 23.5 μm

One of the Extrastrong 0 teams consisted of Polwarths.

Each trial was analysed separately with means, Pearson's correlations and regressions calculated using the SAS package (SAS 1985) on a mainframe. These values were calculated for various subsets of the total data. Repeatabilities of traits were calculated from an analysis of variance (Turner and Young 1969) or from correlations of hogget performance with lifetime performance. Data from the two New Zealand trials were combined and analysed using a general linear model (GLM) with fixed effects of age/year, strain, trial site and their interactions. CFW or CFWP was included as a covariate to study the relationship between FD and CFW or FDD and CFWP. The significance of strain and trial site were analysed by comparing the GLM solutions with and without CFW or CFWP pooled by these effects.

Least squares means for each strain for each production character were derived for estimates of strain performance. The derived traits (GFWP, CFWP, YLDD, FDD) were compared with the values presented by Hygate and Atkins (1988a,b) for the phenotypic relationships between CFWP and FDD in Australian bloodlines, by treating strain and bloodline means as single data points and conducting an analysis of covariance.

Results and Discussion

New Zealand Trials

The wethers in both New Zealand trials showed similar changes in CFW, FD and BW with age (Table 1). The regression of FD on CFW in all sheep over all years at Otago was

FD = 16.3 + 1.5 x CFW,

ie. FD increased by 1.5 micron for every 1 kg increase in CFW. This relationship did not vary much between years (1.5 - 2.3 micron/kg). At Marlborough the relationship each year was from 1.3 - 1.8 microns/kg CFW. (See Figure 1). When data from all years at Marlborough were used the regression was

FD = 16.7 + 1.4 x CFW,

while regression of the full data set resulted in the relationships

FD = 16.5 + 1.5 x CFW and

FDD = .01 + 0.06 x CFWP.

Analysis of covariance was done to study the effect of strain on these relationships (Table 2). Solutions to the GLM models with and without strains pooled resulted in finer wool strains having a significantly lower FD response to a change in CFW than stronger strains. The solutions given in Table 2 are obtained by using data from all sheep within a strain over all years. There was however a significant difference between sheep within a strain in the regression resulting from CFW/FD changes that occur with age/year. These changes can be compared with those that occur by way of breeding and selection.

Calculations based on heritability and variance values given by Turner and Young (1969) suggest it takes the same time to improve a flock by 1 kg CFW as it takes to decrease FD by 4 microns if selection is based on only one trait. This ratio is similar to the difference in the average production of the strains (Table 7, Dunlop 1962). The slope of the relationship between FD and CFW decreases as the level of aggregation of the data declines, ie. between strain means slope > within strain, all years slope > within strain, within year slope.

Modelling work has shown that the relationship between CFW and FD makes the improvement of financial returns by feed supplementation very difficult in Merinos as financial gains from improvements in CFW are negated by increases in FD (Cottle and Bowman, 1990).

Table 1. Least Squares Mean Production x age at the two trials (all sheep)

			Age (years)			
Trait			1	2	3	4	5
CFW (kg)		0*	2.2a+	3.3b	3.9d	4.5e	4.3g
	M		2.1a	3.0c	3.9d	4.2f	4.1f
YD (%)		0	70.5a	70.5a	72.7c	71.4ab	69.4d
	M		71.3b	72.6c	71.5b	72.5c	70.7ab
FD (mm)		0	19.6a	21.5c	22.7ef	22.9ef	23.0f
	M		20.0b	20.6d	21.0g	22.6e	22.9ef
BW (kg)		0	33.7a	40.9b	51.4d	54.1g	53.4g
	M		n.d.	47.0c	56.5e	60.4h	61.5i

* 0 = Otago, M = Marlborough, n.d. = no data

+ means not followed by the same letter differ significantly (P <0.50)

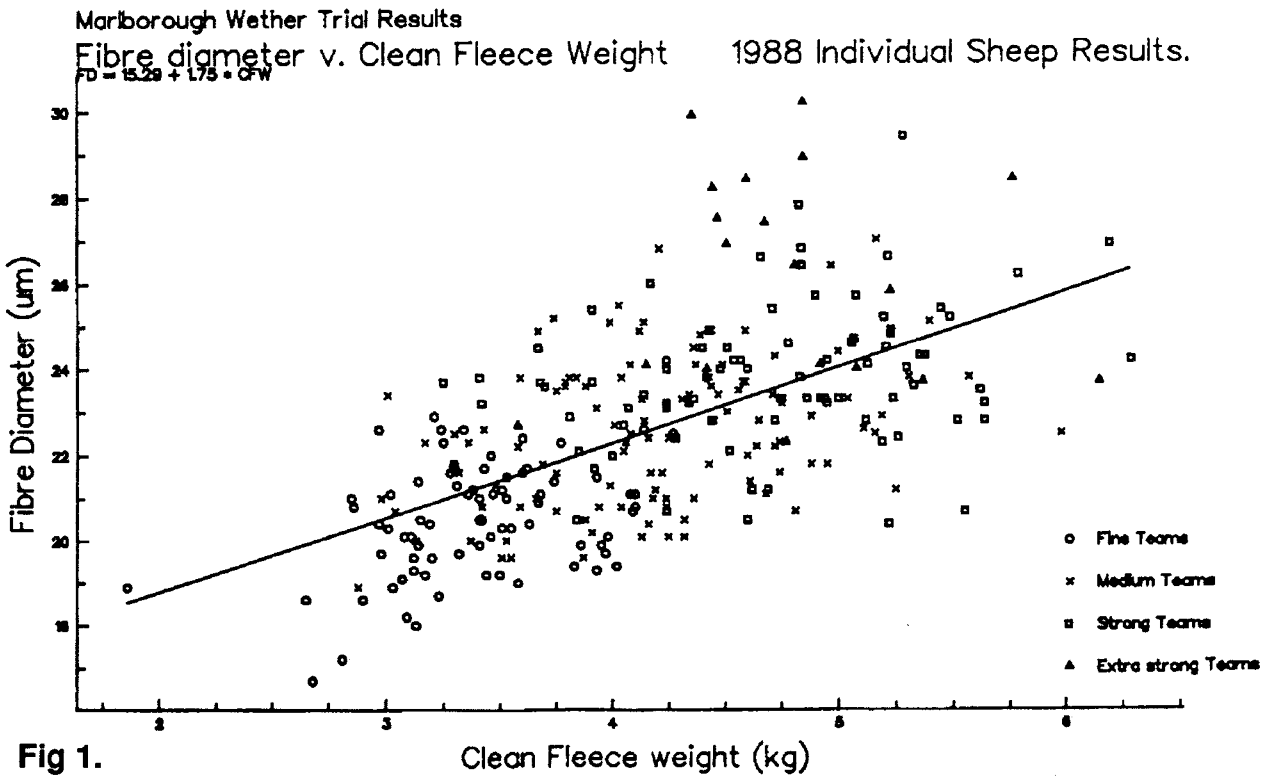

Fig 1.

Table 2. Estimate of strain effects on the FD/CFW relationship

Data set		[1]CFW x strain	[2]CFW
1) Both trials	Fine	0.74	
	Medium	1.11	1.47
	Strong	1.35	
	XStrong	1.80	
2) Marlborough	Fine	0.69	
	Medium	1.02	1.38
	Strong	1.22	
	XStrong	1.63	
3) Otago	Fine	0.75	
	Medium	1.22	1.54
	Strong	1.50	
	XStrong	1.99	

[1] FD = constant + (trial) + CFW x strain
[2] FD = constant + (trial) + CFW

The production of sheep in the different strains can be compared (Table 3) to determine the economics of running different micron sheep (Wilson et al. 1986). The price premiums required to make wool returns from fine strains worth more than stronger strains can be simply calculated if stocking rate/feed intake factors and reproductive rates are not considered. These premiums are affected by an unknown amount by the non-random selection of the sheep which represent the strains.

The fine wool strains at Otago and Marlborough only had to receive premiums ($/kg) of 3 and 22% respectively over the medium wool strains to be more profitable. The 1989/90 AWC Reserve Price premiums for 19 and 20 μm wools compared to 21 μm are 23 and 48% respectively, which suggests that if these production values are valid, then fine wool production is more profitable in the Otago and Marlborough areas. Recent wool prices suggest the premium will remain at this level in the medium term (Anon 1989; Figure 2).

The phenotypic correlations between the measured traits over all years and all strains are shown in Table 4. These correlations for each year, each strain and year x strain for both trials are available from the authors.

Some correlations varied with strain, eg. CFW/YD correlation was

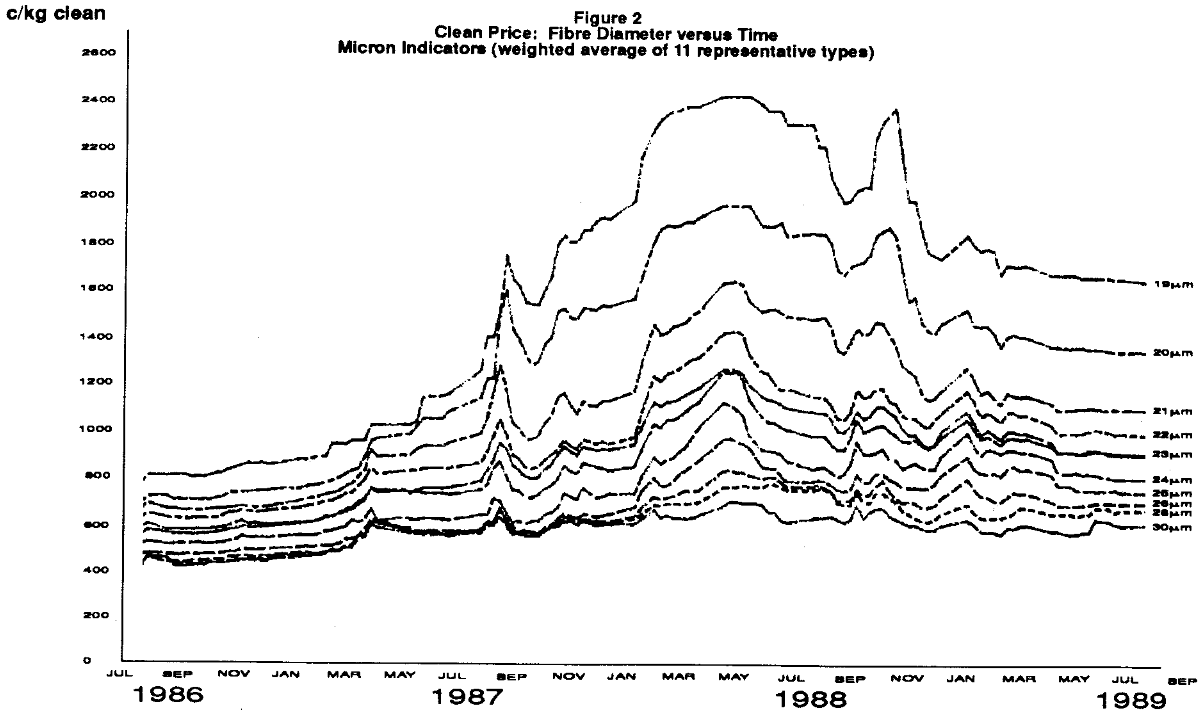

Figure 2
Clean Price: Fibre Diameter versus Time
Micron Indicators (weighted average of 11 representative types)

Source AWC (1987, 1988, 1989)

Table 3. Least Squares Mean Production over 5 years x strain at the two trials

Strain	No. Teams	Trait CFW (kg)	FD (µm)	BWΔ (kg)	Breakeven# Price(%)
Fine	O 3	3.37^{a*}	19.5^{a}	43.6^{a}	3
	M 9	2.84^{b}	19.6^{a}	50.9^{b}	22
Medium	O 13	3.46^{a}	21.2^{b}	46.5^{c}	10
	M 12	3.47^{a}	21.3^{b}	57.1^{d}	10
Strong	O 12	3.82^{c}	22.8^{c}	46.6^{c}	6
	M 9	3.81^{c}	22.4^{d}	59.2^{e}	3
XStrong	O 2	4.05^{d}	25.2^{e}	50.6^{b}	
	M 2	3.94^{cd}	24.3^{f}	59.7^{e}	

= % premium the wool required, to have the same total fleece value as the next strongest strain.
Δ = Otago - years 1-5 average Marlborough - years 2-5 average
* means not followed by the same letter differ significantly ($P < 0.05$)

lower in fine wool, FD/YD was positive in Extra strong strains (higher yield with coarser wool) and negative in fine woolstrains (higher yield with finer wool). Finer wool strains had sheep with the higher yielding fleeces having slightly lower greasy fleece weights, but higher clean fleece weights of finer wool. Selection for greasy fleece weight would still be highly successful in all strains, as clean fleece weight and greasy fleece weight had correlations of over 0.9 overall and every year. However measuring yield is cost-effective in many breeding situations, particularly when sheep screened on GFW are measured (Cottle 1987).

Table 5. Repeatability of traits

	Otago	Marlborough
CFW	0.83	0.80
GFW	0.86	0.83
YD	0.75	0.74
FD	0.88	0.86

Some correlations varied greatly from year to year, eg. CFW/BW had a low correlation in the final year at Otago. However in the first year (1984) when selection of sheep would normally take place, the correlation at Otago was high (0.6). The correlation was naturally higher when all years' data are taken into account, as the sheep increased in both CFW and BW, until four years of age. The CFW/BW correlation was higher at Marlborough and was 0.6 in all later years.

Table 4. Correlations x trial* (all data)

	CFW	GFW	YD	FD	BW
CFW	1	0.96	0.23	0.63	0.74
GFW	0.98	1	-0.04	0.67	0.75
YD	0.18	-0.02	1	-0.09	-0.07
FD	0.63	0.64	-0.02	1	0.48
BW	0.74	0.78	-0.05	0.53	1

The repeatabilities of all characteristics when determined by analysis of variance were over 0.7 (Table 5). This may have been due to the wide diversity of sheep types present, with the finer strain sheep always having finer, lighter fleeces and not overlapping with the stronger strains. However, the repeatabilities of all traits were still very high within strains at both trials when determined by this method.

The repeatability of all traits was highest in the fine wool strains, followed by the strong wool strains at both trials.This may reflect the more closed, fixed nature of these strains where some closed bloodlines have a large influence, eg. Merryville and Collinsville respectively. The popular beliefs that fine wool Merinos breed truer to type and have a lower FD response to increased nutrition may have some substance and suggests they will respond to the introduction of outside bloodlines with hybrid vigour.

From a breeding perspective the more relevant repeatability value is derived from the correlation between hogget performance and average lifetime performance (Table 6).

The high correlation of hogget performance with all subsequent years suggests that little is gained by measuring Merino fleeces for extra years before making selection decisions. The correlations with average performance over years 2-5 resemble repeatability values that are typically quoted (Mortimer 1987). The wethers in the fine wool Otago teams had higher CFW values than those at Marlborough (Table 3) and had a higher repeatability of CFW (Table 6). There are no obvious reasons for this as they were reportedly selected at random by their owners.

Comparison with Australian Trials

Hygate and Atkins (1988ab) presented estimates of bloodline performance with standard errors for GFWP, YLDD, FDD and CFWP. Hygate and Atkins (1988a) found the correlation for FDD with CFWP between 10 bloodlines in 12 wether trials was 0.81. The regression of bloodline means was

$$FDD = 0.01 + 0.13 \times CFWP$$

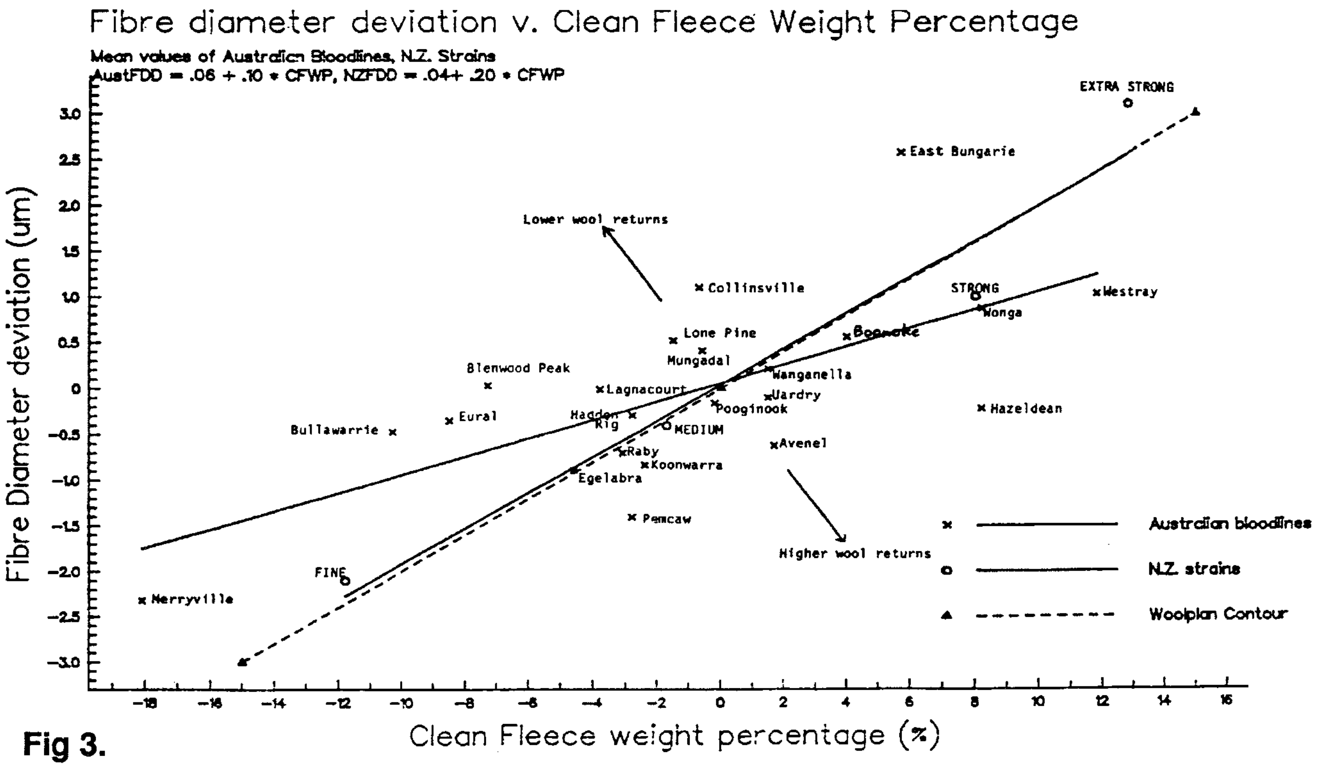

Fig 3.

$(r^2 = 0.64)$
for 10 Australian bloodlines and

$$FDD = 0.04 + 0.20 \times CFWP$$

or

$$FD = 2.3 + 5.5 \times CFW$$

$(r^2 = 0.95)$

for New Zealand strains. The slopes were not significantly different so the New Zealand strains had similar CFWP/FDD relationships to the Australian bloodlines with a pooled relationship of

$$FDD = 0.13 + 0.15 \times CFWP - 0.11 \times COUNTRY$$

(Australian bloodlines, COUNTRY = 1, New Zealand strains, COUNTRY = 0).

The CFWP and FDD results from 22 bloodlines (16 wether trials, Hygate and Atkins, 1988b) are presented and compared with the least squares means for the four New Zealand strains in Figure 3. The regression of bloodline means in this larger dataset was

$$FDD = 0.06 + 0.10 \times CFWP$$

$(r^2 = 0.45)$.

This slope was significantly lower than that estimated for the New

Table 6. Correlation between hogget performance and performance in later years

Strains			Years 2	3	4	5	Average 2-5
CFW	all sheep	0	.72	.66	.62	.56	.67
		M	.65	.61	.58	.54	.63
	fine	0	.93	.91	.90	.92	.93
		M	.57	.52	.49	.39	.52
	medium	0	.56	.51	.44	.41	.51
		M	.55	.46	.32	.20	.40
	strong	0	.63	.54	.48	.46	.55
		M	.63	.54	.62	.54	.63
	XStrong	0	.50	.71	.72	.53	.66
		M	.41	.53	.59	.68	.60
FD	all sheep	0	.82	.81	.79	.76	.82
		M	.80	.76	.74	.72	.78
	fine	0	.62	.73	.64	.62	.69
		M	.77	.74	.65	.59	.73
	medium	0	.66	.66	.67	.63	.69
		M	.67	.64	.57	.49	.63
	strong	0	.70	.67	.62	.58	.66
		M	.65	.54	.55	.53	.58
	XStrong	0	.87	.75	.72	.64	.76
		M	.67	.60	.59	.64	.64

0 = Otago, M = Marlborough

Table 7. Least squares means (± s.e.) of strain performance for GFW, GFWP, YD, YLDD, CFW, CFWP, FD, FDD, BW and BWP (see text for symbol explanation)

	Fine	Medium	Strong	XStrong
GFW (kg)	4.4 ± 0.03	4.9 ± 0.02	5.4 ± 0.02	5.6 ± 0.05
GFWP (%)	-12.0 ± 0.68	-1.8 ± 0.41	7.9 ± 0.46	13.1 ±1.00
YD (%)	71.4 ± 0.22	71.4 ± 0.13	71.3 ± 0.15	71.1 ± 0.32
YLDD (%)	0.3 ± 0.16	0.1 ± 0.10	-0.1 ± 0.11	-0.8 ± 0.24
CFW (kg)	3.1 ± 0.03	3.5 ± 0.02	3.8 ± 0.02	4.0 ± 0.04
CFWP (%)	-11.8 ± 0.72	-1.7 ± 0.43	8.0 ± 0.48	12.8 ±1.06
FD (mm)	19.6 ± 0.08	21.3 ± 0.05	22.7 ± 0.05	24.8 ± 0.11
FDD (mm)	-2.1± 0.08	-0.4 ± 0.05	1.0 ± 0.05	3.1 ± 0.11
BW (kg)	45.9± 0.26	50.3 ± 0.16	51.5 ± 0.17	53.5 ± 0.38
BWP (%)	-7.7 ± 0.50	-3.0 ± 0.31	-0.6 ± 0.34	3.6 ± 0.74

Zealand strains.

A comparison of the FD/CFW relationships was not possible as FD/CFW results were not published by Hygate and Atkins (1988ab).

The relationship for New Zealand strains results in the strong wool strains having the highest wool returns if WOOLPLAN (Ponzoni 1988) estimates of wool prices are used ($8/kg clean, $0.4/kg/µm,ie. 10% CWP = -2 FDD). Avenel, Hazeldean, Pemcaw and Westray have the best estimated wool values of the Australian bloodlines if WOOLPLAN values are used (contours of equal value run parallel to the WOOLPLAN contour in Figure 3). These values probably underestimate the value of FDD in fine and medium strains (Cottle 1990b), so that the fine strains are currently the most profitable (Table 3).

Estimates of strain performance for all traits are shown in Table 7.

Hygate and Atkins (1988ab) suggested that standardised methods of recording data and linking of wether trials with common bloodlines/teams would improve the precision of measures of bloodlines differences and would enable bloodline x environment interaction to be assessed. Both comments are relevant to planned future trials in New Zealand and it would be of interest to include some Australian teams in these. The problem of defining the bloodlines of the various contributing properties is even more difficult in New Zealand compared to Australia.

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