



Fine Wool

Proceedings of the 1982
Merino & Halfbred Producers' Seminar

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Lincoln College

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Stud Merinos and halfbreds in New Zealand

A. E. Van Asch*

The first Merinos in New Zealand were said to have been left by Captain Cook on his second voyage in 1773. They did not, however, survive. It is difficult to be sure who was next to import Merino sheep, but by the mid-1840s there were some quite large numbers of Merino sheep being imported, some by Mr Bidwell and other by Charles Clifford, for Wairarapa stations, and the Deans Brothers in Canterbury. Clifford and Weld in Marlborough are said to have had 11,000 Merino sheep at Flaxbourne Station by 1850.

The Merinos were very popular in those early days because they were readily available from Australia which was by far the closest source, and which by 1848 had already 12 million sheep. Also, the Merino was well suited to the large runs and native grasses of the stations which were being settled at that time, particularly in the South Island.

Through the 1860s and 1870s the Merino breed expanded quickly, as did the stations, but in the 1880s wool prices dropped and so the needs changed. As early as 1868 Merino ewes were crossed with English Leicester rams and through the 1870s long wool rams were increasingly being used. Sheep management and methods changed with the advent of refrigeration in 1880 and the successful voyage of the ship "Dunedin", with that historic first cargo of frozen meat to England in 1882. Intensive sheep farming started with the growing of crops to feed sheep for the meat trade, and so the halfbred came into existence with the

availability of Merino ewes to crossbreed with long wool rams to give heavier carcasses with better conformation. From the halfbred came the Corriedale, New Zealand's own contribution to the sheep owners of the world.

Foundation of Stud Flocks

It was not until 1853 that a stud flock was formed. This stud was founded on 12 ewes and two rams from pure German Merinos which were purchased in Sydney and brought to Christchurch. In 1860 George Rhodes paid Stg.12.10s each for six ewes and six rams in France which were brought to New Zealand as the foundation stock for his flock. In 1866, George Rutherford of Leslie Hills, bought from Mr Murray of Mt Crawford, South Australia 51 rams and 50 ewes. It is interesting to note that in 1901 Mr Murray paid 500gns for a stud ram. The first flock (No. 10 in the Flock Book today) was founded on Tasmanian sheep by John Macfarlane in 1878. Other studs still listed in the Flock Book were founded in 1850, 1880, 1903 and so on, so it can be seen that there has been a continuing need for registered Merino stock in New Zealand.

The halfbred stud history is not so clear but the No. 1 flock in the Book was founded 96 years ago, in 1886, by Sir George Clifford. The Lincoln, English Leicester and Romney all appear as being used in the early flocks, as is still the case in halfbred flocks today.

Those mentioned are some of the older studs in the history of the two breeds in New Zealand and it must be remembered that there are new breeders with new ideas

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coming into the industry all the time; which is a natural and healthy thing, not only for the stud breeders but also for the commercial flocks.

At the turn of the century there were 14 million Merinos in New Zealand. This number has decreased to only 1.5 million. The decrease was not due to any shortcoming in the Merino but to more intensive farming, and the importance of meat for the freezing trade. Another factor was the lack of a premium for fine wool.

The place of the Merino in New Zealand farming is in the high country of the South Island where most other breeds would find it difficult to survive, let alone produce an income for the farmer. Merino ewes are also in demand for the breeding of first cross halfbred sheep. Romney rams seem to be preferred in Otago, English Leicester in the foothills of Canterbury, and Lincoln in Marlborough. In New Zealand today there are 2.5 million halfbred sheep.

The Merino and halfbred stud breeders are very conscious of the need to produce sheep that will produce well and suit the commercial breeder. As stud breeders we have a duty to supply the client, who in this case is the commercial farmer, with what he wants. Many studs are owned by commercial breeders who breed rams mainly for their own use. This reflects the versatility of the breed with breeders developing sheep for their particular need, whether it be in a 38mm or 152 to 255mm rainfall area, steep mountains, snow risk country or flat dry plains — the Merino can be at home on them all. This is the reason why there appears to be so many small studs of 50 to 100 ewes within our 59 studs which last year mated 11,200 stud ewes. In the halfbred section last year, 23 studs mated 5,700 ewes.

Because of this versatility within the Merino, and a relatively small number of pedigree stock, we have depended to a large extent on the large genetic base of the Australian flocks for our out-cross or new bloods. However, since October, 1977 we have been unable to import sheep from

that country because of an embargo under health regulations. This embargo was first brought in because of the Blue Tongue scare and has since been continued because a chronic respiratory disease, which resembles maedi/visna, has been found in goats in western Australia. This may be transmitted to sheep — I stress, may be. As it has an incubation period of up to two years, the problem our Animal Health Division has can be appreciated.

While as a country we are dependent on the export of our primary produce and our markets must not be jeopardised, the Government and the Animal Health Division at times seem reluctant to communicate, or even discuss, the reasons behind the embargo of animal imports. The Merino Breed Committee is in constant contact with its counterpart across the Tasman and this is very helpful when trying to identify the implications of these Australian diseases. I am sure the Australian breeders would like to be able to export to New Zealand.

Personally, I do not think the import embargo of sheep from Australia has affected our flocks at this time, but with small numbers of different blood lines it will be necessary to get some new imports before too many years have passed.

After many years of not exporting Merino sheep because of an agreement with Australia, over the last three years we have had a quota of 50 rams per year which may be exported. This quota was agreed to when Australia lifted their export ban to other countries for the export of up to 300 rams per year. I am pleased that we have sold up to our limit in most years with New Zealand Merinos having gone to India, Hungary, Rumania, Uruguay, China and Peru. Although we hear little about the sheep's performance, from what we have heard it seems these sheep have done well in their new environments.

There have been discussions about changing the halfbred name as it would be likely they would be in demand for export. However, the halfbred name is widely

known and used in the wool trade and a change could be a disadvantage. And, in these days of new breeds appearing regularly, who would change the name of a breed that is nearly 100 years old?

The Merinos of today have, naturally, changed from those of the past with progressive generations of studmasters seeking to follow the current farming practices. However, no-one should disregard 100 years of breeding at the drop of a hat, or the flick of a switch. No-one will say there is no room for improvement and we should all be striving for improvement of the breed. There are new aids which are now available to help studmasters — recording systems, fleece weighing and measurement, but some of these are not that new, having been used for years, if only by the studmaster's eye appraisal. A lot is heard about the scientific approach to breeding — sit in your office and it all happens — but I am

sure there is still plenty of room for the experienced stockman's eye, and I suggest to you all, not to go overboard on any one characteristic in breeding but keep a good balanced sheep. Fertility and high lambing percentages are always to the fore in breeding discussions and it should be noted that a .1 kilogram lift in wool production would return about \$15 million and a 10 per cent lift in lambing percentages would return \$7 million. I am sure that .1 kilogram of wool would be easier to attain and maintain than a 21 per cent lambing increase which would be required to produce the same return. Remember, a lot of our costs are on a per head basis too.

In conclusion, I am sure that the Merino and halfbred stud industries are in good shape. As with any farming scene there will be ups and downs but there will always be a need for fine wool; for wherever fashion-conscious people meet, wool is close by.

Fleece measurement and Merino breeding programmes

B. J. McGuirk*

The operation of efficient sheep breeding programmes depends principally on three factors. These are:

- (i) The characters we attempt to improve are major contributors to the financial returns or production costs of commercial producers.
- (ii) The characters we wish to change are heritable and will respond to selection, and
- (iii) Selection in the ram breeding flocks is directed towards the improvement of characters of greatest economic importance.

If these principles are adhered to, then the programme is likely to make the greatest possible contribution to increased profitability in the breed or industry as a whole.

The New Zealand Sheeplan Scheme has emphasised production characters which affect total lamb production, principally ewe reproductive performance and lamb survival and growth. The recommended selection indexes give less emphasis to wool production. While this emphasis may reflect the relative importance of these traits in breeds such as Romney, Coopworth and Perendale, fleece weight and aspects of wool quality assume much greater importance in the Merino. The remainder of this paper will be devoted to methods for increasing wool production. At the same time attention will also be given to aspects of wool quality which influence the price received per kilogram of wool produced, and the effects of selection for increased fleece weight on wool quality, growth and reproduction.

Genetic variation in Merino sheep

While there has been comparatively little attention by research workers to the genetic improvement of Merino sheep in New Zealand, there is a great body of information on genetic variation in production characters in the Australian Merino which is of relevance to the New Zealand Merino industry. I will attempt to indicate important differences between the two industries where that is appropriate.

Genetic variation can be considered at two levels, genetic differences between flocks and variation within flocks. In Australia, where the identity and characteristics of strains and even of bloodlines are well-accepted, there is growing interest in looking for possible between-flock difference in production as an avenue to genetic improvement. Differences probably also exist in genetic merit between Merino studs in New Zealand.

Within-flock selection

In considering within-flock selection, the first question to ask is how much variation exists for fleece characters even in stud flocks that have had very few, if any, introductions of outside blood, and where a consistent breeding policy has been followed for many years? In Figure 1, I have attempted to describe the variation in clean and greasy fleece weights in just such a large Australian Merino stud. Each year fleece weights are recorded on approximately 2,000 rams that come up for classing. They are usually about 12 months of age when shorn, and had previously been shorn as lambs.

The fleece weights in Figure 1 have been presented in terms of Clean and Greasy

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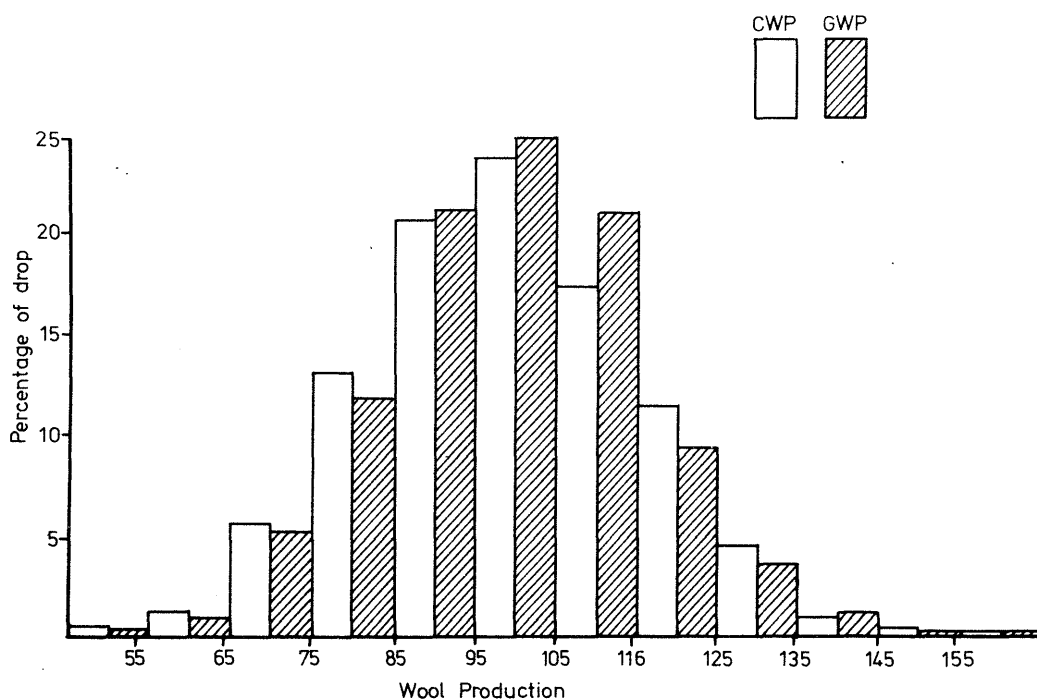


Figure 1. Variation in clean and greasy wool percentages in a complete drop of rams.

Wool Percentages, CWP and GWP respectively, and not in actual weights. For example, the clean fleece of each ram is expressed as a percentage of the drop average. A CWP of 100 means that the ram cut exactly the same amount of clean wool as the drop average. A figure of over 100 means that the ram cut more clean wool, and below 100, less than the drop average clean fleece weight. Similar calculations and conclusions can be made for greasy fleece weight and greasy wool percentages.

If we look at the distribution of Clean Wool Percentages in Figure 1 we can see that a small proportion of rams, less than 1 in every 100, cut less than 60 per cent of the flock average. At the other extreme, some animals have a CWP of over 150 per cent. Put another way, these animals cut more than half as much again as the drop average. The bulk of the animals will of course have clean wool percentages about the average, between 90 and 110. This distribution pattern for clean fleece weights is

very similar to that for greasy fleece weights when they are expressed in terms of greasy wool percentages (GWP).

The same general picture will also hold for other fleece characters. In Table 1 I have described the distribution for average fibre diameter in two drops of rams from the same stud described in Figure 1 and where all rams are shorn and fleece tested. Rather than giving actual diameter values, the data summarised in Table 1 have been expressed relative to the drop average. In addition, the deviation from the drop averages have been rounded to give an approximate deviation from the drop average. For example, a value of -3 would mean that a ram was about 3 microns fewer than the drop averages but that its actual deviation from this average could be between -2.5 and -3.5 microns. At the other extreme, positive values ($+1$, $+2$ and $+3$ microns), indicate that rams were stronger than the drop average by about 1, 2 or 3 microns respectively. A value of 0 means

Table 1. Proportion of rams in different fibre diameter grades in two complete drops of rams

| Mean Fibre Diameter | Diameter Grades | | | | | | |
|---------------------|-----------------|------|------|------|------|------|-----|
| | -3* | -2 | -1 | 0 | +1 | +2 | +3* |
| 20.1 | 3.2 | 13.4 | 24.8 | 26.3 | 16.5 | 10.1 | 7.7 |
| 21.9 | 6.2 | 14.1 | 18.7 | 23.8 | 18.8 | 10.8 | 7.6 |

*Note: The -3 grade includes all rams about 3 microns and **finer** than the drop average. Similarly the +3 grade includes all rams about 3 microns and **stronger** than the drop average.

that the ram is about drop average, and that is actual diameter deviation from average is somewhere between 0.5 microns finer and 0.5 microns stronger than the drop average. As with the fleece weight distribution in Figure 1, most animals are about drop average (-1, or +1 microns), but there is still considerable variation.

Not all of the variation I have described in Figure 1 and Table 1 can be attributed to genetic effects. The proportion of the total variation which is genetically determined is usually referred to as the heritability of a character and it is only the heritable variation that can be exploited in a selection programme. In an operational sense, the heritability is the proportion of a sire's superiority in a character such as fleece weight which is exhibited by his progeny.

In Table 2 I have listed heritability estimates for fleece production characters in Australian Merino flocks. The list is not exhaustive but it does include the major studies in the strains referred to. The fleece characters were all recorded on animals of 14 to 18 months of age, carrying 10-12 months wool. The heritability estimates can all be described as moderately high, generally of the order of 40 per cent. With estimates of this size an animal's own performance is a good guide to its breeding value. Replacement breeding stocks, rams and ewes, can thus be selected on the basis of their own performance as hoggets. If rams and ewes are selected for increased fleece weight for example, reasonably rapid progress can be expected in hogget wool production with the need to progeny test rams.

These predictions of progress are borne out fairly well if we examine responses which have been obtained in selection flocks maintained by CSIRO and by the NSW Department of Agriculture. Some of the flocks were selected solely for increased clean fleece weight; in other words, the necessary numbers of ram and ewe replacements were selected solely in order of hogget clean wool production. In other flocks, selection was primarily for increased fleece weight, but some selection pressure was used to hold crimp frequency or fibre diameter constant, and then sometimes an attempt was also made to reduce skin wrinkle and face cover. Each selection flock was run with an unselected control flock and progress in the selection flock each year was measured as the deviation in clean fleece weight from the control population.

Some of the selection flocks described in Table 3 have now been maintained for over 25 years. The average rates of improvement, averaged over the five flocks, is slightly over 1 per cent per year. This is slightly less than the rates of response predicted, but is still in good general agreement with predictions.

Correlated changes

There are two major reasons for establishing the selection flocks referred to in Table 3. The first was to see if the predicted rates of response were observed in practice. The second reason was to see which other characters changed as a result of selection for increased fleece weight.

The idea that fleece characters are correlated is well accepted by practical sheep

breeders. For example, there would be general agreement that, within a flock, the animals with the "heaviest fleeces" tend to have wool which is visually stronger than the flock average, as assessed by crimp frequency of the wool. These same heavy cutting animals also have wool with a measured fibre diameter stronger than average. Associations measured in this way are referred to as phenotypic correlations. To predict likely changes in crimp frequency or average fibre diameter when we select for increased fleece weight we need estimates of genetic correlation. These can be visualised as the measure of association

between a sire's relative performance for fleece weight, and the average performance of his progeny for crimp frequency, fibre diameter or any other character we may be interested in. Often phenotypic and genetic correlations are quite similar, which is not surprising, as phenotypic correlations are simply the added effects of genetic and environmental correlations. The only major exception in Table 3 refers to the correlations between fleece weight and body weight. Within a flock the largest sheep tend to produce the most wool; the phenotypic correlation is positive. But genetically the two characters tend to be unrelated.

Table 2. Heritability estimates for some hogget fleece and body characters in Australian Merino sheep

| Character | Strain | Heritability Estimate (%) | Average Estimate (%) |
|-------------------------------|---------------------------|---------------------------|----------------------|
| Greasy fleece weight | Fine | 30 | 40 |
| | Medium Peppin | 40 | |
| | Medium Peppin | 42 | |
| | Strong (South Australian) | 46 | |
| Clean fleece weight | Fine | 29 | 36 |
| | Medium Peppin | 47 | |
| | Medium Peppin | 40 | |
| | Strong | 29 | |
| Average fibre diameter | Fine | 46 | 46 |
| | Medium Peppin | 47 | |
| | Strong | 45 | |
| Yield | Fine | 56 | 48 |
| | Medium Peppin | 39 | |
| | Medium Peppin | 49 | |
| | Strong | 48 | |
| Body weight | Medium Peppin | 36 | 55 |
| | Medium Peppin | 65 | |
| | Strong | 63 | |
| Staple length | Fine | 36 | 46 |
| | Medium Peppin | 56 | |
| | Medium Peppin | 43 | |
| | Strong | 51 | |

**Table 3. Annual rates of improvement in clean fleece weight
in Australian Merino selection flocks**

| | | Size of Flock | Duration of Experiment | Annual Rate of improvement (% per year) |
|---|---|---------------------------|------------------------|--|
| (a) Flocks selected solely for increased fleece weight | | | | |
| Flock 1 | | 5 rams, 100 ewes | 1951 till present | 1.09 |
| Flock 2 | | 1 ram, 30–50 ewes | 1954–1976 | 1.58 |
| | | Size of Flock | Duration of Experiment | Annual Rate of Improvement (% per year) |
| (b) Multi-character selection flocks | | | | |
| Flock 3 | High clean fleece weight with checks on crimp frequency, skin wrinkle and face cover | 6 rams 200 ewes | 1947–1972 | 1.03 |
| Flock 4 | High clean fleece weight with checks on skin wrinkle and fibre diameter | 5–15 rams 200–600 ewes | 1950–1978 | 1.05 |
| Flock 5 | High clean fleece weight with checks on skin wrinkle and either fibre diameter (1950–52) or crimp frequency (1961–76) | 5–8 rams 100–250 ewes | 1950–1976 | 0.85 |

The following is a summary of some phenotypic and genetic correlations with clean fleece weight:

Phenotypic Correlations

Within a flock, sheep with well-above average clean fleece weights tend to have:

- (i) wool with noticeably fewer crimps per inch
- (ii) less noticeably, their wool has a higher average fibre diameter, a higher yield and longer staples
- (iii) above average body weight.

Genetic Correlations

If we select for increased fleece weight, we can expect to produce progeny with:

- (i) wool with noticeably fewer crimps per inch

- (ii) less noticeably, their wool will tend to have a higher average fibre diameter, and a higher yield and longer staples.

- (iii) virtually no change in body weight.

Estimates of genetic correlations can be tested by comparing the flocks selected for increased fleece weights (Flocks 1 and 2 in Table 2) with their corresponding control flock for other characters of interest. In Table 4 I have summarised changes in a number of characters over a five year period, corresponding to 15 years of selection in Flock 1. After this period, animals from the selection flock averaged 17 per cent more clean wool, and also produced more greasy wool. Yield, staple length and average fibre diameter were all higher, crimp frequency was lower, while there was very little difference in body weight be-

tween the flocks. All of these correlated changes are of course in good agreement with predictions.

The selection flocks can also be useful in examining correlated changes when there is inadequate information on estimated genetic correlations to make reliable predictions. For example, there is still comparatively poor information on possible

genetic associations between hogget fleece weight and ewe reproductive performance. The small changes observed in fertility in selection flocks so far examined would suggest that the two characters are virtually uncorrelated; selection for increased hogget fleece weight should not lead to a decline in flock fertility.

Table 4. Changes in hogget fleece and body characters following 15 years selection for increased fleece weight

| | Flock Selected for Increased Clean Fleece Weight | Unselected Control |
|--------------------------------------|--|-----------------------|
| Clean fleece weight (kg) | 3.11 | 2.67 |
| Greasy fleece weight (kg) | 4.65 | 4.27 |
| Yield (%) | 68.4 | 62.9 |
| Body weight (kg) | 35.0 | 35.5 |
| Staple length (cm) | 9.5 | 9.1 |
| Crimp frequency (Crimps per inch) | 8.5 | 10.7 |
| Fibre diameter (microns) | 22.1 | 20.6 |

Extensive studies have also been undertaken on the efficiency of conversion of feed to wool in animals from the high fleece weight selection flocks listed in Table 2 and their corresponding unselected control flocks. The overwhelming evidence is that the gains in fleece weight per head are due to gains in the efficiency of conversion of feed to wool, and not because animals in the high fleece weight selection flock eat more. If the gains had been due entirely to increased intake, the economic benefits of the programme would be rather questionable.

Relevance of research to the industry

Breeders may well question the relevance of some of the research findings I have described. For example, are heri-

tability estimates for fleece characters in their flocks similar to those in Table 1? Is an annual gain of one per cent or more a realistic prediction for commercial flocks? And how are possibly unwanted or undesirable changes in average fibre diameter and yield prevented when selecting for increased fleece weight?

I will deal firstly with the question of heritability estimates. The values given in Table 2 cover a range of Merino strains and bloodlines in Australia, and the flocks could be regarded as typical of industry flocks of the 1940s and 1950s, when they were established. Selection for increased production will in time reduce the heritability of those traits, but the effect is unlikely to be dramatic. However, if breeders seriously doubted if there was genetic variation for characters used as fleece weight

in their flocks, heritability estimates can be obtained by progeny testing rams which differ in fleece weight.

The estimates of heritability included in Table 2 are for hogget fleece characters measured on 10–12 months wool growth. At this age the effects of an animal's age, its birth type (whether born as a single or twin) and the age of its dam on production are small. If fleece characters are recorded at a younger age, or if the hoggets have not previously been shorn as lambs, then the effect of these environmental factors increases. Unless adjustments are made to production data to account for these identified environmental effects, the heritability of a character is reduced and so too is the expected rate of progress in a selection programme. In the New Zealand context, where pedigrees are kept on registered stud Merino sheep, it would not be difficult to adjust fleece characters for these effects, and to preserve the efficiency of the selection programme.

Fleece weights are positively correlated with average fibre diameter. For this reason, if we select solely for increased fleece weight, we can expect average fibre diameter in the flock to increase too. To prevent this correlated change in diameter, which most breeders would regard as undesirable, rams that are about 2 microns and more above the flock average should not be used as stud sires. This same approach can be used to prevent other possibly undesirable consequences, such as the expected increase in wool yield if we select for increased clean fleece weight.

Fleece measurement in Merino selection programmes

I would firstly like to emphasise what I see as the role of fleece measurement in Merino breeding programmes. Fleece measurement, like all the forms of objective measurement, should be seen as a selection aid, to complement but not replace traditional classing methods. The two approaches should perhaps be seen as

having separate objectives. Traditional classing has a role in maintaining the standards of visual excellence in the flock, and for identifying animals with specific faults (excessive skin folds, and face cover etc.) which can be assessed accurately by eye. Fleece measurement has the aim of ranking animals for fleece characters that can be recorded objectively.

Measurement has two advantages over subjective assessment for production characters. Firstly a ranking of animals on measurement is likely to be more accurate and there is considerable evidence in Australia that this is so for characters such as fleece weight. Secondly, measurement provides a breeder with an objective check that the emphasis given to production characters is in accordance with his intentions. For example, the breeder may wish to give major emphasis in his selection to fleece weight. Measurement provides an objective check on how well actual selection decisions reflect that wish. These two advantages hold for fleece characters such as average fibre diameter and yield, as well as for fleece weight.

The major use of production information is in the selection of sire replacements in a stud or central nucleus flock. Selection decisions made there determine the rate of genetic progress made in the commercial flocks a stud provides with rams or in the contributing flocks in a co-operative or group breeding scheme. Ram selection is much more critical than ewe selection, because fewer rams are required for breeding purposes.

While only a minority of Australian Merino studs rely heavily on fleece measurement as a selection aid, a somewhat more consistent approach to measurement is now being used by Merino studs, especially those in New South Wales. Rams are shorn as lambs and at classing prior to yearling shearing the visual culls are identified and removed. Breeders are then encouraged to greasy fleece weigh all remaining rams, both those which might later

be used as stud sires, a group which in Australia is generally referred to as the reserve rams, and those sold for use in commercial flocks. The rams finally used as sires can subsequently be selected with the aid of more detailed fleece measurement information, including clean fleece weight, average fibre diameter and yield.

There is a growing amount of information on the emphasis given to fleece characters in Australian Merino selection programmes. For example, I recently completed a study on three drops of rams from each of two studs. These studs are large in that they annually class over 1,500 rams each, and are somewhat unusual in that they obtain full fleece measurement information on all hogget rams, including their visual culls. Their breeding objective is to improve fleece weight while holding or improving fleece quality and the general physical appearance of the flock.

In Stud 1, approximately 40 hogget rams are selected as new stud sires each year. In the three years studied the average Greasy and Clean Wool Percentages (GWP and CWP) of the rams selected was 131 per cent. In Stud 2, where again approximately 40 new rams were selected as

stud sires each year, their average GWP was 123 per cent.

Measurement can also be used to grade flock rams or to calculate the average production of grades that may have been identified visually. There is less need for detailed production information on flock rams than there is for potential stud sires. The quality of flock rams sold to commercial flocks will not influence the rate of genetic progress in the commercial sector; that is determined by the rate of progress achieved in the stud or central nucleus flock. The quality of flock rams a commercial producer obtains will only determine how far behind the stud he is likely to be, and the genetic merit of his flock relative to other producers who obtain their rams from the same source. For this reason information on greasy wool production is probably sufficient in most cases, although some producers may also wish to know if rams are about average for their drop on average fibre diameter, or finer or coarser than the average. In this context, the fibre diameter grading system described in the earlier parts of the paper and in Table 1 should be perfectly adequate.

Selection in New Zealand fine wool flocks

R. Jopp*

There are a number of basic points to be considered in any sheep selection programme:

1. Objectives must be clearly defined and stable. Genetic improvement is a long term project and frequent changes to follow fashion or the market result in no progress.

2. In setting objectives we should concentrate on as few traits as possible. The more traits we select for, the less progress we make in any one. It is also important to avoid concentration on fine "stud" points.

3. We need a basic understanding of:

(i) **Heritability** tells us by how much characters will respond to selection. Fortunately in Merinos the main traits we select for have a high heritability response (except fertility). Heritabilities based on measurements of traits at 15–16 months of age are higher in Merinos than measurements taken at an earlier age.

(ii) **Repeatability** tells us the likelihood of an animal's measured superiority in one year being maintained throughout its life. All except fertility, are high.

(iii) **Correlations** give us an idea of what will happen to one trait when we select for another. Points to note are:

- Greasy and clean fleece weight are highly positively correlated.
- Fleece weight is positively correlated with fibre diameter. Increasing fleece weight will result in slight increases in fibre diameter.

— Fleece weight and body weight are positively, but not highly, correlated.

4. Selection methods must be practical, i.e. able to be applied in our management system and be appropriate for the culling level available.

5. Selection procedures should be kept simple. Complex systems simply do not last.

6. Selection methods must be effective. For example, to improve weaning weight in Merinos it is actually better not to select on weaning weight, but on 15 months body weight, because there is a much higher heritability of body weight at 15 months and there is a high positive correlation between 15 months body weight and weaning weight.

7. Selection methods must be economic.

8. Environmental effects on sheep appearance and performance are major. The mob of sheep to be selected from must be run as one mob until selection is done. Also, twinning and age of dam will affect performance until hoggets are at least a year old. In our stud, average twin fleece weight is about 10 per cent less than that of singles (shearing at 10½ months old).

9. Management and feeding are of great importance because:

- (i) culling is dependent on lambing percentages; and
- (ii) genetic differences are masked by poor feeding.

10. Performance records are a vital aid to selection.

11. Physical soundness must override all other selection criteria.

*Moutere, Alexandra.

Table 1. Heritability and repeatability of traits

| | Heritability | Repeatability |
|-----------------------|-----------------------|-----------------------|
| Greasy fleece weight: | | |
| at 15–16 months | High 45 per cent | High 65 per cent |
| at 10–12 months | High 33 per cent | |
| Clean fleece weight: | | |
| at 15–16 months | High 40 per cent | High 65 per cent |
| at 10–12 months | High 30 per cent | |
| Body weight: | | |
| at weaning | Moderate 25 per cent | |
| at 15–16 months | Very High 55 per cent | Very High 75 per cent |
| Fibre diameter | High 40 per cent | High 55 per cent |
| Greasy colour | High 35 per cent | — |
| Fertility | Low 0–10 per cent | Low |

Table 2. Genetic correlations

| | Clean Fleece Weight | Body Weight | Staple Weight | Average Fibre Diameter | Weaning Weight |
|--------------------------|---------------------|----------------|---------------|------------------------|----------------|
| Greasy fleece weight | + High | + Low-Moderate | + Moderate | + Low | |
| Clean fleece weight | — | + Low | + High | + Low | — |
| Body weight at 15 months | + Low | — | — | — | + Very High |

Specific objectives are up to the individual, but I would suggest:

- (i) sound conformation;
- (ii) size (body weight);
- (iii) fleece weight;
- (iv) wool type, especially colour, handle and staple formation;
- (v) fibre diameter or quality number, but the specific fibre diameter to aim for is a decision of personal preference.

I have not mentioned fertility because I do not think it is important to select directly for fertility (through twinning) in Merinos. Indirect selection is done by selection for body weight and by culling dry ewes. If you want to increase fertility dramatically, buy a Booroola.

In a commercial flock most of the total genetic improvement will come from the rams (up to 80 per cent), so ram selection must receive priority:

- (i) Know what you want and stick to it.
- (ii) Good communication with your ram breeder is essential.
- (iii) The choice of ram breeder with the type of sheep you want, and making genetic progress in the direction you want, is of more importance than choosing the individual rams.
- (iv) If using performance records:
 - The deviation from average is what is important.
 - A realistic approach must be adopted. It is difficult to get rams that are above average in all

characteristics. Also, the stud's average genetic merit should be well above your own flock's, so that even slightly below average rams would be improvers in your flock.

- Ram buyers must be prepared to pay more for performance recorded rams (especially in fine wool breeds where the measurement methods can be expensive) and substantially more for top rams.

The majority of selections of ewe replacement in New Zealand fine wool flocks has to be done at weaning. This is certainly not desirable in the late maturing breeds we are dealing with, but practical considerations compel us to adopt this policy:

- (i) Lambing percentage may not allow a high enough culling rate to enable more than a minimum visual culling level.
- (ii) Lack of hogget rearing country and high costs of wintering hoggets may limit the number of hoggets able to be carried to the number required for replacements.

Selection at weaning has to be by eye appraisal and, with experience, a reasonably efficient job can be done. The important characters in fine wool sheep (soundness, size, fleece weight and wool type) can all be judged by eye.

To use fleece weight or body weight for selection you need:

- (i) A reasonably even line of hoggets for wool type.
- (ii) To cull visually.
- (iii) To be able to winter substantially more hoggets than you need for replacements to make selection worthwhile.

In selecting for fleece weight in ewes:

- Greasy fleece weight is adequate. Excessively greasy fleeces can be noted and the sheep culled.
- The Wool Board has a fleece weight calculation service.
- Be aware of possible environmental effects on weights (including the effect of twinning).

— Watch for increase in fibre diameter.

Body weight may be an alternative to, or used with, fleece weight. It has some advantages over fleece weight in the flock situation:

- (i) It can be done at 15–16 months of age when environmental effects are largely overcome.
- (ii) 15 months body weight in Merinos is very highly inherited.
- (iii) Body weight is positively correlated with fleece weight and fertility (but low correlation).
- (iv) It is simpler and quicker to carry out.

In commercial flocks the main benefits of measurement are probably indirect:

- Interest in, and awareness of, the importance of fleece weight and body weight is increased.
- The measurements are a useful management aid.

Selection in halfbreds is somewhat different to selection in Merinos because we are relying on the cross and the resulting hybrid vigour for our performance lift. Because of the genetic instability there will be a greater proportion of off-sorts, and even with a high lambing percentage the culling potential may be exhausted by a visual culling. Genetic improvement really relies on improving the base breeds — the Merino ewe and longwool ram.

Some have suggested inbreeding the halfbred with heavy selection pressure to maintain performance with the aim of producing a more stable breed, but this has been done before (Corriedale, Polworth) and the vigour and hardiness would be hard to maintain in the inbreeding situation.

The halfbred is a very productive, no-nonsense breed which by its nature requires heavy culling to maintain an even flock — a small price to pay for its attributes.

It is clear that genetic improvement in both Merinos and halfbreds is heavily dependent on the ram breeder and his selection programme.

To date, fine wool breeders in New Zealand have done a good job because:

- (i) Stud breeders are well aware of commercial requirements as most studs are run as part of much larger commercial flocks.
- (ii) Fine wool breeds are not numerous and have not been subject to the same fashion pressures as other breeds.
- (iii) Fine wool studs have been using sound breeding techniques for many years:
 - pedigree recording and progeny testing since at least my grandfather's time;
 - performance recording (fleece weight, yield testing) for at least 30 years.

The major observable result has been an improvement in yield and, presumably, in clean fleece weight. In our stud, since 1948, when my father began fleece weighing and yield testing, the yield of the ewe fleece lines has increased from around 66 per cent to about 75 per cent. This is typical of progress in other studs and has been passed on to the fine wool clip as a whole.

Selection in studs has a more positive slant than selection in flocks. The poor sheep are culled, but the top sheep must also be found. This need justifies (and requires) the use of all possible aids that are effective and economic.

As an example of a stud ram selection procedure, I will run through the procedure we follow, which is typical of other studs:

Two-tooth rams classed in January:

- 20 per cent of lamb drop already culled by eye at six months of age;
- 20 per cent culled now on performance and visual assessment;
- 55 per cent available for sale;
- 5 per cent kept as reserves.

Selected by eye, on own recorded performances and record of dams, of the 20–30 kept, only two or three will be used in the stud. The ultimate test of these rams used in the stud will be their progeny. These we identify with coloured tags so we can draft them into sire groups whenever they are in the yards. The merits of each sire are

very easily seen (and also his faults) when his progeny are assessed as a group like this, whereas looking at the lambs individually often leaves you with no clear idea of what each ram has produced on average.

To further improve our breeds in the future, we must:

- (i) Make more use of performance records. Traits such as body weight and fibre diameter will have to be measured and recorded in addition to fleece weight and yield, which are already used.
- (ii) Improve our recording systems. This will probably mean a move to computers, but I am not sure that Sheeplan (even with the fine wool option) is the answer.
 - It is possibly too sophisticated. A thorough understanding of the breeding values and index is required, even by the flock ram buyer and this is not easy.
 - If selection is done on the index, genetic progress is moving in directions unknown (as far as individual traits are concerned), other than towards more money (by the Sheeplan authors' assessment).
 - Over-emphasis is placed on fertility and meat production.
 - The paper war is increased and not reduced, which is surely the main benefit expected of any computer use.

Two advantages Sheeplan does have are the promotion of the use of performance records, and the fact that its deadline dates force us to have our records up-to-date.

I think there is a need for a simpler, more flexible recording system based on mini-computers which could be used by the breeder himself and in his yards. For fine wools it could be designed around the Lincoln wool-testing service.

- (iii) Concentrate on improving fine wool breeds' ability to handle improved

pastures and more intensive management. This boils down to more careful selection for constitution and conformation. Foot conformation, for example, seems to be highly heritable, and I am sure progress can be made in reducing horn growth on improved or irrigated pastures. Breeding resistance to footrot is a long shot. Very few sheep exhibit resistance and so heritability is probably very low and assessment of resistance is difficult. Culling badly affected sheep is probably the best that can be done.

The unavailability of Australian rams may be a good thing, because we are now forced to breed and select for our own stud rams. This could

lead to a Merino better adapted to New Zealand conditions. Because of the need to watch inbreeding if the Australian connection remains closed, and to increase selection pressure to increase improvement rates, it may be necessary to consider allowing top-performing and inspected ewes to be brought into studs.

In conclusion, I would emphasise:

1. the need to preserve a balance in sheep selection between experience and new ideas, and between performance recording and eye assessment;
2. the need to set clearly defined objectives and to pursue them ruthlessly; and
3. Look after the sheep and the money takes care of itself.

The fine wool market

M. E. Moss*

The subject on which I am to speak to you would seem to give me ample opportunity to digress and I intend to take full advantage of this.

I would like first of all to say how pleased I am as a woolbuyer to be able to speak to a captive group of growers, the opportunity, in my opinion, does not occur often enough, and I feel that for two groups who are so closely allied there appears to be insufficient liaison between us. I am sure there would be a lot to gain, for both sides, in a frequent exchange of views.

Lately it has been disturbing to hear of some harsh criticism of the marketing of our agricultural products, by inference wool is included in this. Let's face it, it is always easy to be critical when things are not going so well, but we should not be blind to the efforts of those who are constantly striving to expand and develop our products. The wool market has changed markedly in recent years, swinging away from the involvement of big international merchants who used to buy our wool and service their clients at the other side of the world. Today money is too expensive and the Wool Board is now called upon to fill this gap instead.

The woolbuyer, and by that I mean the traditional auction buyer, has not been standing still and is constantly seeking out and creating new markets and continuing to serve the old ones. The difficulties at present are world wide and are not just reflected in the prices obtained for New Zealand agricultural products. The Iranian market is one area where great hope was held for expansion in wool and meat, but recent problems point out the instability of some of our new markets.

The role of the woolbuyer has not changed markedly over the years, but his method of operation today bears little resemblance to that of twenty years ago. In

the past, many times, the price of wool was affected by wars, by a President's illness, maybe by a merchant taking a stock position on the day. But today we see less movement in the price of wool, and for a buyer the daily fluctuation in currency is his main area of concern, and the ever increasing cost factor of transporting and maintaining teams of buyers around the wool auctions is causing a new approach into sales by separation.

At auction we have seen a big change to sale by sample and this has entailed some adjustment in buying techniques. The changeover from the conventional showing of wool to the present level of sample selling has taken time, but in the last two seasons it has taken big strides forward and has the acceptance of all sectors. There is still room for improvement, particularly in the area of inter-lotting, and this is one area where considerable progress can be made with the acceptance by the grower of allowing his line of wool to be combined with other suitable growers' lots.

The showing of a micron and yield on a certificate has undoubtedly helped the finer end of the wool market more than any other, and it is pleasing to be seeing once again a distinct price difference between wools having been classed out for fineness. The availability of the certificate as a valid description in the sale of the goods has a distinct advantage to the buyer once it is accepted by his overseas client, this must do away with any concern at the possibilities of any disagreement at a later stage, and consequently the buyer can bid on the wool with confidence.

However, it should be remembered that the present certificate only shows yield, micron and vegetable matter, and this still leaves quite a number of other factors to

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be assessed by the buyer. Colour, length, tenderness, cottiness and spinability being the ones that come easily to mind.

One thing that cannot be stressed enough is the importance today of good shed preparation. With the increase in sale by sample and use of the certificate it might sometimes be thought (though heaven forbid!) that it is alright to throw it all in, and it all comes out with a micron and yield and a sample all mixed up in the box. To anyone who suggests that, I would get them to view the bales at the mill on the other side of the world and hear their reaction, as it is still the bales that will be delivered, not the sample. I think that sometimes one is inclined to forget that there are as many choices of raw material as manufacturers in the textile industry, and New Zealand wool must not only be competitive for price but also in its presentation.

Good shed preparation is becoming more important as less re-classing is being done in brokers' stores, and it is most important to have your Merino and halfbred wools, the cream of our clip, well presented.

I know shed presentation is going to be well covered elsewhere in this seminar so rather than say any more on the subject, I will stick my neck out and say instead, "What are we doing with breeding? There are some funny looking animals about these days." You might well ask what do I know about sheep breeds, and I would have to answer — "Nothing" — but I know what a sweet looking halfbred or Corriedale looks like, and some of the present crosses are beyond description. Naturally in my remarks I am referring to their wool as I see it when it has been presented for auction.

It would appear that in striving for fertility and dual purpose sheep that sometimes wool gets forgotten, or is conveniently overlooked. Most crossbreeding starts off with the best intentions and in their proper controlled breeding they are quite suitable for the purpose. But what

happens to the culls which find their way to the sale-yards, and which are then bought to build up someone else's flock.

It is bad enough when we get these problems in the coarser end of our clips, but it is often disastrous when we get it in the fine end of the halfbred and Corriedale wools. Good wool appears to be becoming restricted. I can remember not too many years ago we used to buy a lot of Paper Felt wools for our overseas clients, thank goodness that demand has dwindled as today we find it hard to fill the few orders that we do get.

From a woolbuyer's point of view I think that it is unfortunate that, when looking for a better return per stock unit, it is usually the wool that suffers. I realise than many times it has been pointed out that the best wool does not always get the return it deserves, but it can usually be said that good wools do retain their level in a depressed market, and I also feel it is unfortunate if we do not continue to have the better style of wools in order to attract the added competition that these wools bring.

Having, up to now, been talking more in general terms, let me now look more closely at the fine wool market, and see where it fits into the total New Zealand wool clip. The figures which I intend to use come from the Wool Board's Statistical Handbook, a very informative publication.

Taking a guide from this we see that the production of wools running from 19 to 31 microns is 435,266 bales which is 25.6 per cent of the total greasy wool clip. Whereas it could be said that there may be some fine crossbred wools within this micron range, I think we can fairly assume that the biggest majority of the wools falling into this bracket would be Merino and halfbred.

To break this down further, the production within a range of microns is as follows:

| | microns | bales | |
|------------------|---------|---------|---------|
| Merinos | 19-22 | 26,781 | (1.6%) |
| Merinos | 23-24 | 9,899 | (0.6%) |
| Fine halfbreds | 25-27 | 69,022 | (4.1%) |
| Medium halfbreds | 28-30 | 238,699 | (14.0%) |
| Strong halfbreds | 31 | 90,825 | (5.3%) |

The percentages quoted are against the total New Zealand wool clip, and the figures are pretty similar over the last three seasons.

It can be seen from this that our production of Merino wools is very small, and it is not until we get to the halfbreds that we reach a significant quantity, and that really only in the Medium halfbred bracket.

To whom do we sell these wools? Let us look at another table in the Wool Board handbook and under greasy wool for export, wools in the fineness bracket 28 microns and finer for the 1980–81 season:

| | |
|--|--------------|
| United Kingdom | 14,085 bales |
| Western Europe | 11,274 bales |
| (with Germany at 3,909 and Italy at 2,652 being the two largest) | |

| | |
|---|--------------|
| Eastern Europe | 21,629 bales |
| (with Russia at 7,577, Yugoslavia at 5,428 and Poland at 4,562 the largest) | |

| | |
|-------|-------------|
| Japan | 2,017 bales |
| China | 4,468 bales |
| India | 1,461 bales |

Most of these areas also take wools in the same micron bracket in the scoured state, but most of this wool would be for woollen process so is therefore mainly short wool and lambs' wool.

From the above figures it can be seen that the markets for our fine wools are still widespread, but they have changed, and quite markedly, in some areas.

The United Kingdom is still the biggest market for our fine wools although there has been a slight decline even here, but the remainder of Western Europe has shown quite a big decline, over 60 per cent, with France being the market that has shown the biggest decline. Eastern Europe is more consistent apart from a big increase in the 1978–79 season when all the countries of the Communist Bloc took a larger percentage.

Japan is also showing a relative consistency apart from the 1978–79 season when they also had a big increase, and the same applies to China.

When looking through the total export figures in the 28 micron and finer bracket we find that the figures have shown a decline from 141,000 bales in 1977–78 to 56,000 bales in 1980–81. However, part of this can be shown to be attributable to the operations of the Wool Board. When we look at the figures of their stock levels as at 30th June each year they vary in the brackets 25 to 31 microns from 17,000 bales in 1979 to 104,000 bales in 1981.

While the figures for the finer bracket would appear to have declined, when we look at the lower bracket of 29 to 34 microns there is a considerable increase in our export figures, with by far the largest increase being sold to China.

Overall the markets for our fine wools do not seem to have changed much over the years, but the quantity would appear to vary from one year to the next, and if we consider that the Wool Board figure increases in relation to the fall-off in export, then this is the Wool Board doing its job of plugging the market and disposing of its stocks in the following season when the demand has returned.

This particular season we are coming to the end of, has been a particularly good one for the fine wool producer, with very little of this type of wool having been passed over to the Wool Board. The price for Merinos has stayed relatively stable throughout, the halfbreds, particularly the 27 micron wools, have shown a steady increase since December and are now at the highest point of the season. The average price obtained at auctions for the fine wools this season has been very considerably higher than last season's even before taking into account the SMP.

In our detailing of the consumers of our fine wool we have so far neglected to mention the biggest single buyer, this being the local New Zealand mills. There are no official figures that I have been able to obtain, but my guess would be that close to 20,000 bales a year of Merino and halfbred wools are processed by our local mills, and

this would certainly put them at the head of the list over the last two or three seasons.

The total local mill purchases of all wools, for worsted, woollen and carpets, is given at 144,000 bales in the 1980-81 season, approximately 8 per cent of the total clip. However, when we look at the proportion of fine wools bought by the local mills, this is nearer to 15-20 per cent, so it can be seen that they can have a considerable influence on the market for these wools. It is obviously important for the whole country that we have a healthy local mill participation in our economy, and to get more value-added by exporting. It is in the growers' interest also to keep producing the most suitable wools so that the local mills can produce the quality products needed to expand into the export area.

One of the comments made by those who are critical of our present day marketing is that we should be in fact manufacturing more cloth, knitwear, carpets, etc. to add more value to the local product instead of just exporting wool in its raw state. This sounds very fine and I doubt if there is anyone who would disagree with that idea, but first of all the markets have to be found to sell these finished products to. There are a great many other countries also producing textile goods which are at a very competitive price because of lower labour costs and fast, modern machinery. And then there are the tariffs and quota systems, which exist around the world, and on that score you should, sometime, be on the receiving end of some of our larger European

consumers of our raw wool products when they start talking about the protectionism that exists in our own importing policies in New Zealand.

To briefly sum up, the Merino and halfbred wools price wise, have had one of their better seasons with the strength still apparent in the market especially for the finer halfbreds. Some of the traditional areas to which we have been exporting wools have shown a marked decline in their consumption but the ability of the Wool Board to take off the market any surplus quantities has off-set any big decline in prices over recent years, and the strength of the local New Zealand mills despite the restructuring programme following the closure of Mosgiel, still continue to be an important factor.

The advent of sample selling and certification for the fine wools has seen a better differential being observed for price between microns, and this has also opened up the possibility for new markets where the test certificate can be used as a basis for sale.

However, with more wool now being shown in boxes by grab sampling it is important that a skilled and conscientious job of classing is done in the wool shed, so that we can continue to sell our product with confidence that the manufacturer will keep coming back for more. We should never forget, when selling a product there is always someone else in competition waiting to step in and take your place if the standard of presentation should decline.

Wool growth

B. R. Wilkinson*

A brief discussion on the principles of wool growth, will of necessity have to be rather general.

Farmers know that it is in the nature of farming for a gap to frequently exist between 'what should' and 'what can' be done, especially when more than one commodity is produced. The compromise, if one is needed, should nevertheless be well-reasoned and intentional.

This paper will discuss the wool follicle population and its relationship to fleece characteristics, refer briefly to fibre growth and then consider some of the factors that influence wool growth.

I intend to discuss the wool follicle population and its relationship to fleece characteristics, refer briefly to fibre growth and then consider some of the factors that influence wool growth.

The follicle population

If a Merino sheep grows a 5cm fleece each year, this represents an average of about 1mm of wool fibre per week from each of the 60 million follicles. If each short length of fibre were joined end to end the total length of fibre produced in one week would be 60km. In one year this single fibre would be about 3,000km (1,875 miles) long, about twice the length of New Zealand! In chemical terms, it means that each wool follicle makes 20 million keratin units per second (assuming an average molecular weight of 20,000). While it is hard to envisage wool production in these terms, these figures serve to emphasise the capacity of wool follicles for an astonishing growth performance.

Wool follicles develop in the skin of the lambs before birth. By birth the population is complete and no more are produced during the animal's life. The feeding level of the late pregnant/early lactating ewe is thus of special importance, not only for the developing lamb, but also for the ewe herself.

Follicles are about 1mm long, shorter in fine wool breeds, longer in strong wool sheep. Some start producing fibres before birth, with the first formed or primary follicles all growing fibre by birth, and only a portion of the later developed or secondary follicles growing fibres at birth. In fine wool breeds a lot of secondary follicles don't start growing fibres until after birth and it may be some months before the whole follicle population is mature. Feeding level of the lactating ewe will influence the time it takes for follicles to mature and produce fibres and slow maturation precedes fleeces that are more sensitive to break and coting in later life.

There are more follicles in the skin of fine wool sheep than strong wool sheep, with 50–80 million in merinos, 25–35 million in Corriedales and halfbreeds and 15–20 million in Romneys. They are packed tightly in the skin of the Merinos (about 80/sq.mm) and more loosely in Romneys (about 20/sq.mm).

In all breeds, follicles grow in recognised groups, with three primary follicles and from 12–60 secondary follicles per group. This secondary/primary ratio or S/P ratio for short, thus differs between breeds and typically a Merino has a S/P ratio of 20, a Corriedale or halfbred 11, a Romney 6 and Drysdale 4. The number of primary follicles is about the same in all breeds so it is the variable number of secondary follicles which determine these different S/P

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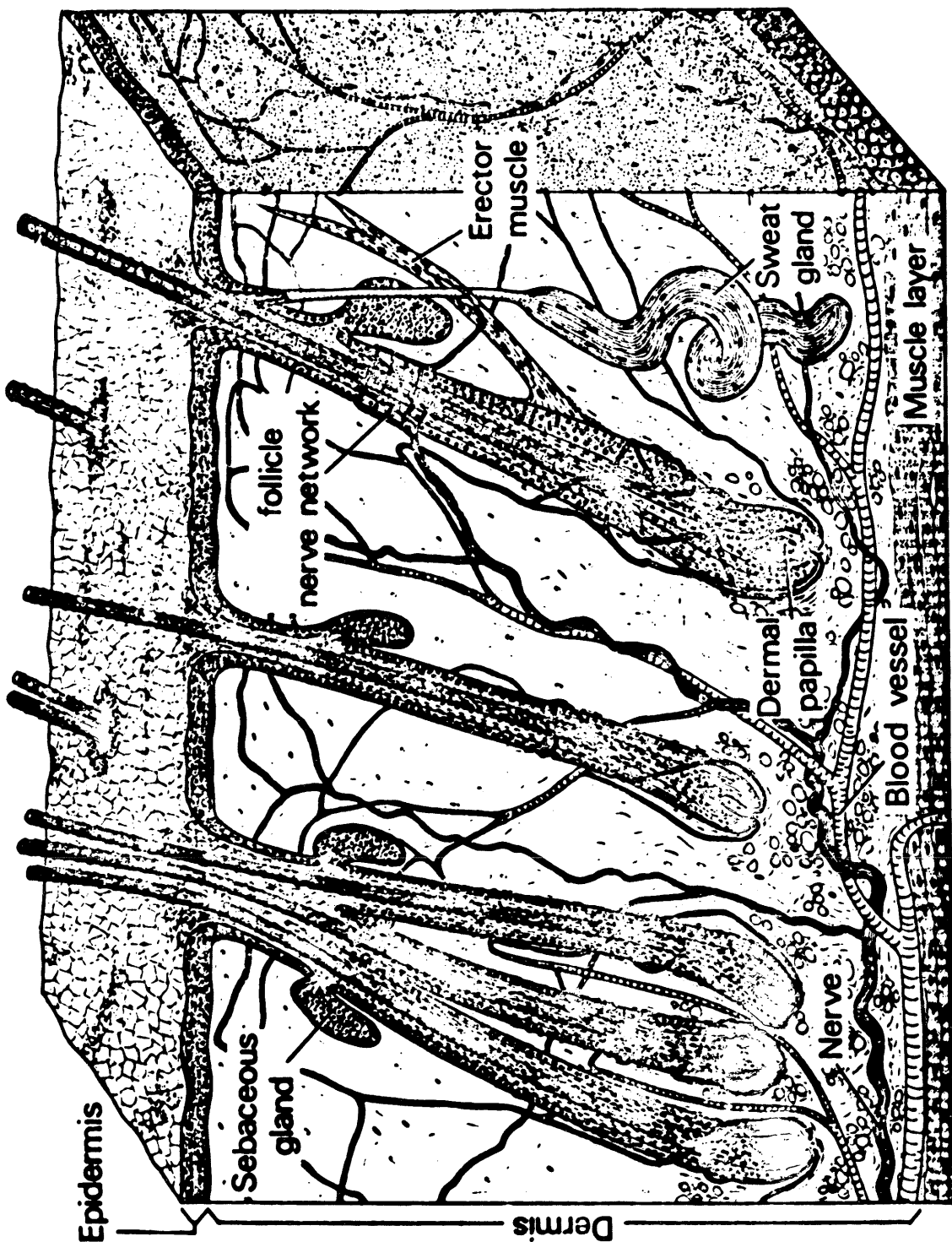


Figure 1. Longitudinal section showing follicle and skin structure. (Source unknown).

ratios and densities of follicles in the skin.

Primary follicles are about the same size as secondary follicles in Merinos, in Corriedales and halfbreeds primaries are a bit larger than secondaries, in Romneys the differences in size are more pronounced and in Drysdale the differences are large. Wax and suint (yolk) in the fleece are produced by the wool follicles. Primary follicles produce both wax and suint, secondary follicles produce only wax.

Follicle/fleece characteristics

If we bring all the information in the preceding section together we find the following:

Merinos

- The wool follicles are relatively small — Merino wool fibres are short, fine, very soft and crimpy.
- There are many wool follicles — Merino fleeces are dense.
- The follicles are of even size — Merino fleeces are fairly even and the staple tip is blunt.
- The follicle produce a lot of wax — Merino fleeces are greasy and low yielding.

Corriedale and halfbred

- The wool follicles are larger, less numerous and less even in size — fleeces are longer, coarser, more open, slightly tippy and higher yielding.

Romney

- The wool follicles are large, less numerous and primaries are bigger than secondaries — fleeces are long, coarse and open.
- Because primary fibres are longer than secondary fibres staples are tippy.
- Because there are fewer secondaries per primary, fleece characteristics are largely dominated by the longer, coarser primary fibre population.
- Because there are fewer follicles producing wax, the fleece is higher yielding.

Drysdale

- The relatively small population of follicles varies greatly in size between primaries and secondaries — the fleece is open, primary fibres are very long and

coarse, secondary fibres are short and fine and the staple is very tippy.

- Because of the low S/P ratio, primary fibres dominate the characteristics of the fleece. (There are still four times as many secondaries as primaries in the fleece, such that the measured average fibre diameter is about the same as a strong Romney fleece, even though the fleece looks much coarser).

General Features

- On individual animals follicle density and S/P ratio are typically highest on the neck — where the fleece is finest and lowest down the back legs — where the wool is coarsest.
- Follicle density is strongly inherited.
- The amount of suint produced in fleeces is about the same in all breeds, but the actual amount in the fleeces is very dependent on seasonal conditions, specifically rainfall.
- Greasy fleece weight can now be viewed as the product of a considerable number of interrelated components.

Fibre growth

Fibres are made of cells. They grow from the base of follicles by a process of cell division. The rate of cell division and the number of cells dividing determines how fast fibre cells are pushed up the follicle shaft. Such factors as feeding level, breed and season affect both the rate and number of cell divisions. Part way up the follicle the fibre cells which are filled with wool protein or keratin, die, dry and harden. The end product, wool fibre, which is not very different from horn, hooves, finger nails or hair in terms of growth and composition, is quite a complex substance.

It is this complexity which makes wool a particularly useful textile fibre. For instance, it can be readily dyed to a wide range of colours and shades, it absorbs water but doesn't wet easily, garments have good wrinkle resistance and recovery, wool can be spun into fine yarns because each fibre locks with its neighbour, it is very safe because keratin chars rather than melts. On

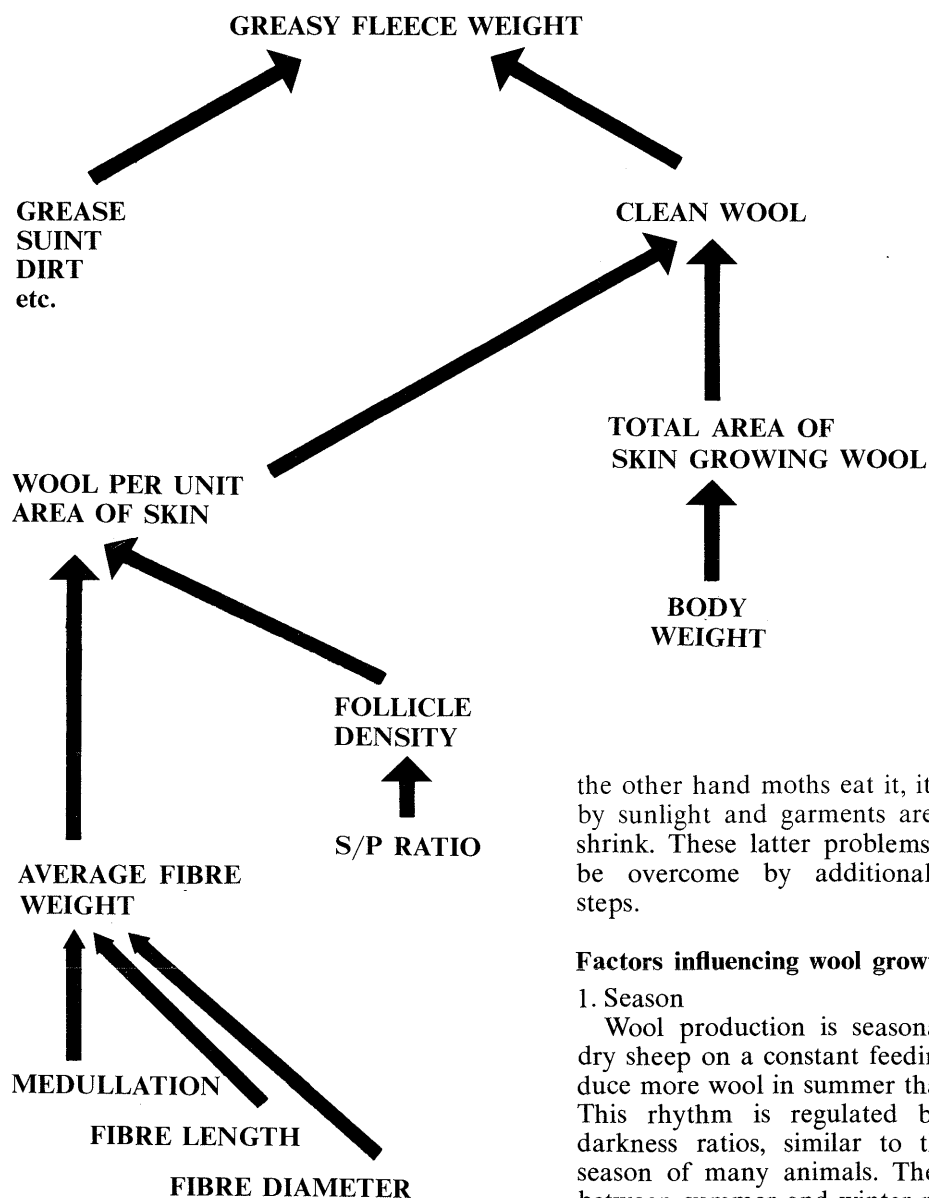


Figure 2.

Greasy fleece weight can be viewed as the product of a considerable number of interrelated components.

(Source: M. L. Bigham)

the other hand moths eat it, it is damaged by sunlight and garments are inclined to shrink. These latter problems can largely be overcome by additional processing steps.

Factors influencing wool growth

1. Season

Wool production is seasonal and even dry sheep on a constant feeding level produce more wool in summer than in winter. This rhythm is regulated by daylight/darkness ratios, similar to the breeding season of many animals. The differences between summer and winter production is small for dry Merinos on constant feeding — about 40 per cent more in summer than in winter, but quite large for strong wool breeds — about 3–4 times more in summer than in winter. The usual fluctuations in feed supply and the depressing effect of pregnancy and lactation on wool production of breeding ewes accentuate the rhythm, such that the winter trough of wool

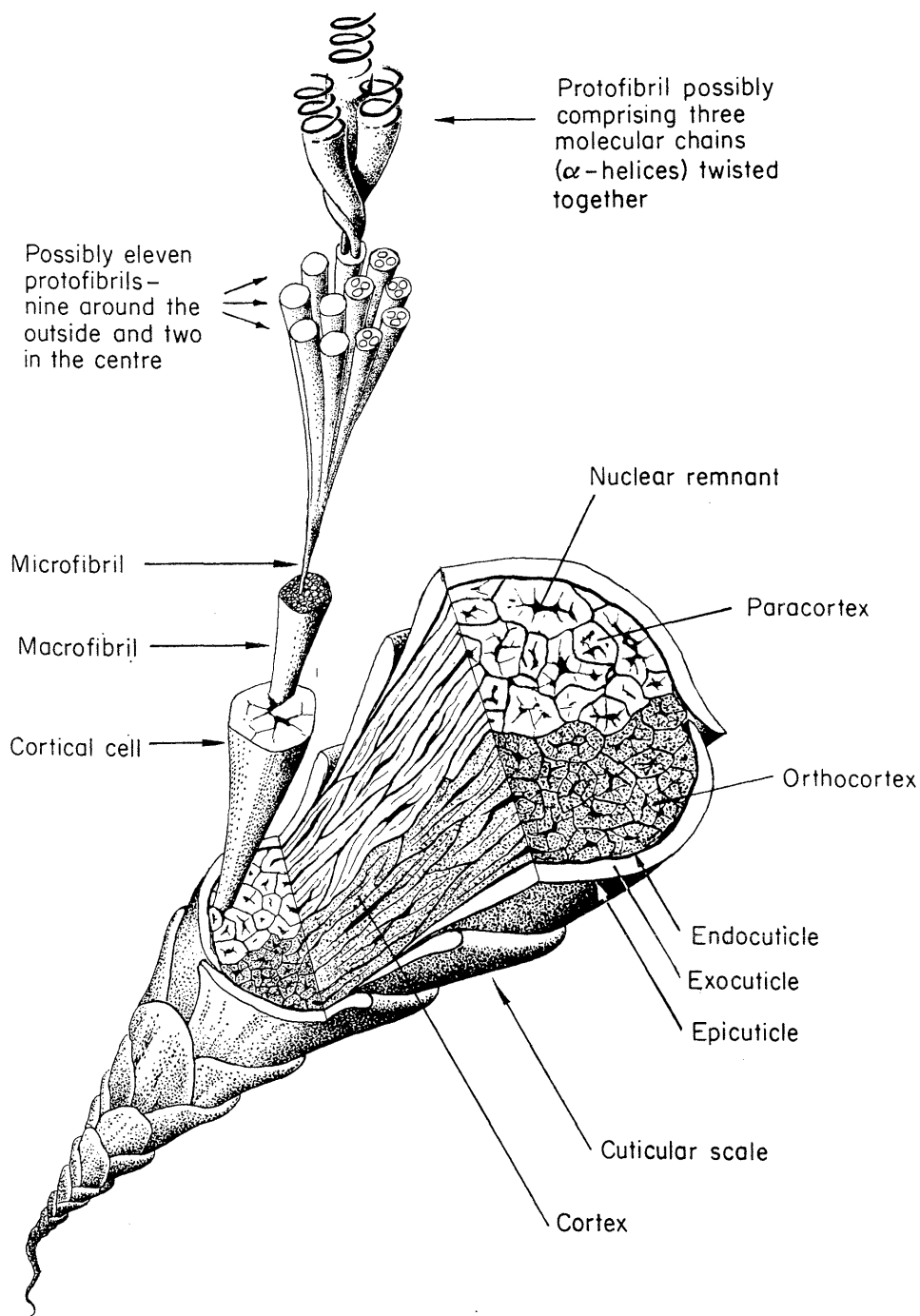


Figure 3. Diagram of the internal structure of a wool fibre. (Source: 'Wool Growth', Ryder and Stephenson).

production is about a month later and is deeper than for dry sheep and recovery is delayed. It is at this time that wool tenderness and break may be evident.

2. Feeding

Feed quality and quantity has a marked influence on wool growth rates. Food is used for maintaining the animal, for body growth, for lamb development (pregnancy and lactation) and for wool production, so the amount of food partitioned to wool growth will vary according to other demands.

During periods of low feeding body tissues are used to support important functions including wool growth and the animal loses weight.

During periods of high feeding body weight increases and wool growth rate increases but not in direct proportion to intake. The amount of wool produced per unit of feed decreases as intake increases. In other words, the efficiency of wool production — food in vs wool out — decreases as intake increases. The best wool producers in the flock, that have the heaviest fleeces at shearing, are generally the most efficient and this high efficiency is not greatly altered by feeding level. The lowest wool producers in the flock are not very efficient at high feeding levels and will not grow extra wool no matter how well they are fed.

The message from this apparently confusing statement is in fact fairly simply stated in four parts:

1. Sheep with the heaviest fleeces are the most efficient wool producers.
2. The most efficient sheep need good feeding to demonstrate their superiority.
3. It makes more sense to feed adequately rather than excessively.
4. Efficiency (fleece weight) is highly inherited.

3. Stress

If maintenance requirements go up, wool production is likely to go down. Bad weather, internal parasites, grazing very

short pasture and shearing are all forms of stress. It is worth noting that following shearing extra feed is required for several weeks simply to hold wool growth at previous levels. If sheep are machine shorn in winter or early spring at a time when wool growth rates are naturally low, the period of stress may be much longer and the effects on wool production quite severe.

4. Pregnancy and lactation

Pregnancy and lactation are other forms of stress. Compared with dry ewes of similar age and feeding levels, ewes rearing single lambs typically show a decline in total fleece weight of between 9 and 14 per cent. The cost of rearing a second lamb is approximately 5 per cent, to give a total decline of 14–19 per cent. When feeding is restricted the penalty is large. A breeding ewe grows most wool in February and March, about a month later than dry sheep and least wool in July and August. These months will vary a little depending on locality, feeding level and lambing date.

5. Breeding and selection

An effective and economic way of improving wool production is to select and breed from superior sheep. Superiority in important fleece characteristics persists throughout the lifetime of the animal and part is passed on to the offspring.

The amount of progress through breeding and selection will largely depend on the difference between the average productivity of the selected portion of the flock and that of the uncultured flock. This in turn depends on three factors, all of which can be regulated by the breeder.

(1) Method of selection. Visual judgement is much less accurate than measurement. In a test, visual judgement for fleece weight was only half as effective as fleece weighing in raising financial returns. In practice it is necessary to cull to some extent by eye for certain undesirable features, but if this is followed by culling on measured fleece weight gains can still be almost doubled. Greasy fleece weighing is the only practical means of selecting the

ewe flock, but it is still not sufficiently accurate for ram selection, where errors can be very costly indeed. Selection of rams should be based on clean fleece weight, and, because visual assessment of fineness is not accurate, on measured fibre diameter.

(2) The number of fleece characteristics. As the amount of progress in any one fleece characteristic decreases when others are included, the number under consideration should be kept low. It is of fundamental importance to know the most important fleece characteristics so that most attention can be paid to them and to be aware that some characteristics are associated with others. An example of this association is fleece weight with efficiency, staple length, soundness, body weight, crimp frequency and measured fibre diameter.

Selection for fleece weight

- improves efficiency
- improves staple length
- improves resistance to tenderness
- slightly increases body weight
- reduces crimp frequency
- slightly increases measured fibre diameter

The adverse effects of the crimp frequency association are reduced by measuring rather than visually assessing fineness. It is possible to reduce the adverse effects of the measured fibre diameter association by either placing a limit or ceiling on

measured fibre diameter (in which case progress in improving fleece weight will be slower), or by alternating selection pressure on each characteristic over short periods, so that some gains are made in each.

(3) Proportion of the flock selected. Breeders must strive for a high culling rate. An example of the benefits of culling, in terms of improvement in average fleece weight and increased returns per animal in the selected flock is illustrated.

Conclusion

In the introduction to this paper I referred briefly to the difficulties of transferring principles into practice. If there is one word which characterises wool, wool growth, properties growing wool, and climate, it is variability, so a set of basic principles may well need to be modified for practice under a certain set of conditions. Two things are certain, however, and they are that both good feeding and good breeding are basic requirements for good wool production.

Good feeding rapidly improves performance, but it can be expensive and wasted on inferior sheep. Good breeding slowly improves performance, but the gains are cumulative and permanent.

As many of the costs of producing wool, are on a per-head basis, high, individual performance is a most worthwhile goal.

Developments in wool selling

A. R. Edmunds*

Introduction

Over the last ten years there have been major changes in wool selling methods in New Zealand. These changes represent but the early stages of a progressive development which is still going on and which will proceed for some time yet. It is my intention to attempt to describe this progressive development to you.

It may be thought somewhat surprising that a scientist should be dealing with the subject of selling which could well be considered the preserve of the economist. However, these developments in wool selling are very much scientifically and technologically based, and it is this aspect which I intend to concentrate upon.

History of Sale-by-Sample

Although it had been in the minds of various people for some years that changes to the wool selling system could be beneficial, it was not until 1967 that any real steps were taken. In that year the Wool Marketing Study Group, set up by the New Zealand Wool Board, the then New Zealand Wool Commission and the Government, made its final report. Whilst that report is mainly remembered for other, more controversial recommendations, its most positive achievement was the initiation of research and development work by the Wool Research Organisation of New Zealand (WRONZ) on a wool selling method which has come to be called Sale-by-Sample.

It is worthwhile to consider why this occurred when it did. A number of factors were involved but I shall mention only two of the more relevant ones. Firstly the costs of the traditional wool selling system were

escalating disturbingly, due to the labour-intensive nature of the system. It was recognised that a major reduction in the handling of wool within brokers' stores would be desirable. Secondly, quite independent of that cost aspect, the market impact of synthetic fibres on the textile processing industry during the 50s and early 60s had resulted in mills becoming aware of the advantages to themselves of processing raw materials having precise technical specifications on their main characteristics. Natural fibres such as wool were at an obvious and potentially serious disadvantage in this regard as they were sold entirely on the basis of subjective assessment. The concept on which WRONZ began to work in 1967 was of a wool selling system aimed at improving the situation for New Zealand wool in both of these areas. In essence the concept was of a selling system based on replacement of subjective assessment of the main value-determining characteristics of wool by scientific measurement of them, supplemented by the provision of a relatively small sample for the buyers to inspect.

Over the following few years a great deal of work was done by WRONZ, in close collaboration with the New Zealand Woolbrokers' Association, and our efforts were keenly watched by the Australian wool industry. Progress was made on several fronts, including development of sampling methods and of methods of wool measurement, demonstration of the potential use of measurement data in improving the standards of wool-store classification, and, very importantly, the gradual understanding of, and confidence in, objective measurement data within the wool trade.

Unfortunately, due to a number of factors, not least of which was the divisive acquisition debate of the early 70s, further

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progress in implementing Sale-by-Sample in New Zealand did not proceed smoothly and logically. However, Australia developed the concept. Following on from keeping an interested eye on New Zealand's progress, the Australian wool industry undertook a \$1½ million, Government funded two year crash programme (the Australian Objective Measurement Project), which resulted in the introduction in 1973 of the system of Sale-by-Sample as we now know it. The subsequent growth in the use of this system in Australia has been little short of spectacular, especially in comparison with the pace of any previous change in the wool industry. At the present time over 95 per cent of the Australian clip is sold in this way.

This Australian system was taken up in New Zealand in 1974 when the brokers and buyers, with assistance from the then New Zealand Wool Marketing Corporation adopted it, initially on a very small scale and on a rather tentative basis. There were considerable ups and downs in the attitude to Sale-by-Sample in New Zealand over the next few years and its future here appeared very doubtful for a while. However, as a result of some WRONZ work in the grab-sampling area, the tide finally turned in its favour about 1977. Since then progress in implementing the system here has been quite rapid, although not at the same rate as in Australia. In the 1980–81 season 57 per cent of all first-time auctions-sold greasy wool was dealt with in this way and that proportion should increase further over the next few seasons. The advantages of Sale-by-Sample are now generally accepted through the industry.

The Sale-by-Sample system

When a grower's lot is received into a broker's store the bales are all run through a sampling line. Each bale has one or two (depending on the lot size) grab samples of about 0.25kg each taken from it by means of a hydraulically operated pair of jaws which are thrust through its side at

a randomly selected position and to a random depth. The bale is then weighed and immediately passed on to a core-sampling machine in which it is temporarily compressed to about half its normal length while one or more core samples (each of about 50g) are taken from it by hydraulically operated steel tubes with sharpened cutters on one end. The bales are then block-stacked and need not be touched again until they are broken out for branding and shipping out after the sale.

The core samples taken from each bale of the lot are all put together in one plastic bag and this composite sample of cores is sent off to an authorised Test House, such as the New Zealand Wool Testing Authority, where the objective measurements are carried out. At the present time the only characteristics of the lot which can be measured are the yield, vegetable matter content, and mean fibre diameter. These measurements must be carried out by methods which are strictly specified by the International Wool Textile Organisation and the results are then issued by the Test House in the form of an IWTO Certificate which is accepted internationally as a valid basis for wool trading. These certified results are also notified to the broker for inclusion in his sale catalogue.

The grab samples taken from each bale of the lot are also amalgamated in one plastic bag and that composite sample of at least 5kg (depending on the lot size) is retained in the broker's store. Immediately prior to the valuing days for the next sale, each of these Display Samples is emptied out of its bag into a large open cardboard box in the Sample Display area of the store. The broker attaches to this box a copy of the IWTO Certificate issued by the Test House for that lot. When the buyers come to value, that 5kg or so Display Sample is all the wool of that lot which they see.

The necessity for the two separate different types of sample from the one lot may need some clarification.

The Test House must have a suitable sample on which to carry out its measurements and extensive research has shown that the core-sampling method, as specified by the IWTO, is the best method for obtaining a sample which meets all the criteria for this suitability. The sample must above all be representative of the lot of wool from which it is taken with regard to yield, vegetable content and mean fibre diameter. It must also be in a form that enables accurate measurements of these characteristics to be made. Furthermore the samples must be capable of being taken from the bales and subsequently tested by the Test House in the most efficient and economical way practicable. Core sampling satisfies all of these requirements.

The Display Sample obtained from the bales by the grab sampling operation is needed by the woolbuyers so that they can assess subjectively the other important characteristics of the lot of wool which, as yet, the Test House is unable to measure. These include length, tenderness, colour, cottedness, crimp, etc., and obviously most of these could not be assessed on the short cut fibres which result from core sampling. Grab sampling, on the other hand, provides a full-length, uncut sample on which these characteristics can be assessed. Once again, it is essential that the Display Sample be representative of the wool in the bales from which the grabs are taken, especially with respect to those unmeasured characteristics which the buyer must assess.

This requirement of representativeness was the basis of one of the major hurdles which had been overcome in gaining trade acceptance of Sale-by-Sample in New Zealand. Woolbuyers were understandably suspicious that as little as 0.25kg taken from each bale of a lot could be capable of providing a Display Sample which would be sufficiently representative, particularly in comparison with the situation in the traditional show-stock where they could examine most of the wool in several opened bales of the lot. They also considered that their ability to make accurate

assessments of length, colour, etc., would be seriously impaired on the new system compared with the old one they knew so well.

Fortunately, investigations by WRONZ were able to show that when grab samples are appropriately drawn from bales of most New Zealand wools, the accumulated Display Sample is fully representative of the wool in the lot. Furthermore, by following a procedure which had proved successful during the Australian Objective Measurement Project, we carried out comparative appraisal trials, in collaboration with the New Zealand Woolbuyers' Association, which demonstrated to them that they could appraise lots of wool just as well "in the boxes" as they could on conventional show bales.

Acceptance by the New Zealand woolbrokers was also not immediate. They too had to adjust to the new system and it took a few years of cut-and-try before some of them found how to adapt the system to their own individual situations and make it work. Once a broker had done this and was able to use Sale-by-Sample on a significant proportion of the wool he handled, worthwhile advantages became apparent. To give a single example: in one large North Island store the number of labour-involved operations in selling each lot of wool was reduced from 22 per bale to 9 per bale after only a season of changing to Sale-by-Sample. All brokers' stores in the country are now using that system to some extent. It is widely recognised that with the changed circumstances in the industry over recent years, involving such factors as the growth in wool production and reduced availability of shipping, it would be virtually impossible now to dispose of the New Zealand wool clip efficiently through the old system.

Development in Sale-by-Sample

But that is far from being the end of the story. As I stated at the beginning, the changes I have been describing have been but the first stages of a progressive

development which is still proceeding. A number of further developments are currently taking place, including one which is now well under way, namely Sale-by-Separation.

This is a very logical development of Sale-by-Sample, in which the grab-drawn Display Samples and the certified test results are physically separated from the bales of wool they represent by transporting them to another centre several hundred miles away. For example, display samples from Invercargill wools can be sent to Christchurch where they are displayed, valued and the wool sold, whilst the bales remain in store in Invercargill. One obvious advantage of this is that it is cheaper to move samples from Invercargill to Christchurch than it is to move woolbuyers from Christchurch to Invercargill. This may seem to be an advantage only to the woolbuyers, but it must be realised that the woolbuyer's costs will always be reflected in the price he is able to pay for your wool. Another advantage of Sale-by-Separation is that it increases the number of selling opportunities the grower has during a season.

Experience gained in operating Sale-by-Separation will certainly lead to improvements in it and a steady expansion of its use in the future. One possible result of this expansion could be Centralised Selling in which the number of wool selling centres could be reduced to only two — one in each island.

In parallel with the development of Sale-by-Separation, there is steady progress in the more technical area of objective measurement. In particular, research at WRONZ, which has been going on for several years, will shortly culminate in a widening of the range of wool characteristics which can be measured by the Test Houses and hence certified pre-sale. We have been developing a method for the measurement of colour in raw wool and our work on this is now almost completed.

Colour is a very important value-determining characteristic of wool, especially in such a diverse wool clip as ours.

The importance lies in the fact that the range of colours to which a textile product can be dyed is governed by the base colour of the fibres from which it is made. Dyeing is a colour additive process so that the fibres can only be made darker by the addition of dyestuff. It is not possible to dye fibres to a lighter shade than their own original one. White wools can therefore be dyed to a wider range of colours than yellow wools and will consequently be of a higher value, particularly when the fickle world of fashion dictates that light pastel shades are "in".

Increasingly today the textile manufacturer must be able to control the shade of his finished products within very tight limits. This, coupled with the economic pressures towards even higher rates of production, has meant that dyeing has had to become an exact science rather than the craft it once was. There is therefore a marked trend towards the use of scientific colour measurement, computer shade matching and computer predicted dye recipes in the dyehouse of the modern textile mill. Such systems require reliable, accurate quantitative data on the base colour of the fibres to be dyed in order to operate at maximum efficiency. The colour measurement method we have been developing is very closely based on such considerations as these.

I do not propose to go into the technicalities of our colour measurement method here. However, there is one aspect of our development which will serve as a good example of a very significant constraint which we must not overlook in all our development work in the objective measurement field. That constraint is the cost of carrying out the measurements in the Test Houses.

It has always been appreciated that the benefits of Sale-by-Sample would be largely negated if the costs of drawing the samples and carrying out the measurements on them could not be held as low as possible. The core-sampling and testing methods presently used, and which I have

already mentioned, comply with this requirement. Now that we are about to add colour to the three characteristics already measured, it is obviously important that this addition should cause a minimal increase in total testing costs. A great deal of the effort we have put into developing the colour measurement method has been the result of this need.

We have achieved this aim by ensuring that the colour measurement can be made on the same sub-samples as are used for fibre diameter measurement. This has involved us in developing a new and improved method of sample preparation which has the added advantage of replacing the most inefficient part of the existing standard preparation procedure for fibre diameter measurement. This is the type of development we are constantly seeking to achieve.

Methods and equipment to enable other wool characteristics to be measured by the Test House are also under development, in particular for Bulk, Medullation and Length.

The work in Bulk has been concentrated mainly on carpet wools, but is certainly not irrelevant to finer wools. Bulk in this context is essentially a measure of the compressional properties of wool fibres and is closely related to the covering power of the tufts in a carpet. It has been found that by measuring the Bulk of raw wool samples, in a quite simple instrument called the WRONZ Bulkometer, those wools can be ranked in terms of the covering power of carpets made from them. Further development is proceeding which should result in an improved measuring instrument and technique which will be suitable for Test House use.

Medullation is a characteristic which is only of real importance as far as its measurement is concerned in carpet wools. Suffice to say here, then, that work is being done to improve another WRONZ device, the Medullameter, for the satisfactory measurement of this characteristic on those wools for which it is warranted.

Length on the other hand is a characteristic of great importance in all wools. It is widely considered to be second in importance only to mean fibre diameter and in fact for some end uses it is more important. A lot of effort has been put into investigations aimed at developing suitable means for measuring length in raw wool, here in New Zealand, in Australia, and in other countries, notably Belgium, and some significant progress has been made. However it is an unfortunate fact that so far no completely satisfactory method has resulted from these efforts which will allow this important characteristic of wool to be measured rapidly, accurately and at an acceptable cost. There is not time here to explain why this seemingly simple problem is proving so difficult to solve but you will hopefully take my word for it that it is a much more difficult problem than you would think. Nevertheless, there are some rays of light on the horizon and it seems justifiable to say that in a few years time we should be able to add length to the other wool characteristics which can be measured for marketing purposes.

The future

When at some time in the future, all of these developments have been successfully completed, we will be in the interesting position of having all the important value-determining characteristics of raw wool that can be objectively measured and certified as a basis for international trading. Then it will be possible to enter the final stage of the progressive development of wool selling I spoke of at the beginning. That stage is being spoken of more and more frequently as Sale-by-Description. By this is meant a system of selling wool in which no samples, big or small, are seen by the potential buyers. All relevant data to enable prices to be set for each sale lot will be given in the form of the results of certified Test House measurements. Many other changes to the total selling system then become possible. One which has been quite a lot of consideration already, es-

pecially in Australia, is Computer Selling, in which this certified data on each sale lot would be displayed on a computer terminal in every woolbuyers' office and bids could be keyed in by each buyer through that same terminal.

This may well sound fanciful. However, systems very similar to this have been successfully operated for many years for the sale of other industrial raw materials (and we must never forget that wool is just that). A very closely related example is that of

cotton. As long ago as 1973 I watched with great interest in a laboratory in Texas where samples of cotton were being measured very rapidly and accurately in a highly automated system which produced computer print-outs of all the important fibre characteristics of each individual bale. I also watched individual bales of cotton being sold, on the basis of that test data alone, over a tele-link. So perhaps it is not just an impossible dream.

Halfbreds and intensive farming

P. J. Wardell*

Mt Dasher is a 8,080ha tussock run in the Kakanui Range, 30km west of Oamaru. Altitude ranges from 400 to 1,500m. The property is long and narrow, with long spurs and deep, steep gullies.

Rainfall is 650mm at the homestead, rising to around 1,000mm at the higher end. A lot of fog and drizzle occurs, often lasting for days on end. Snow lies to 1,100m for the three months of winter, with several light falls over the rest of the property each year. The difference in climate between the high and low ends of the property means that we have some insurance against summer drought and stock can be wintered on the steep sunny faces at lower altitudes with reasonable safety.

At present we have 3,050ha of developed tussock and 800ha of higher altitude Maku lotus, the balance being in large native blocks.

Of the 17,500 stock units carried, there are 9,000 Border-Merino halfbreds, 4,500 Perendales, 550 Merinos and 900 cattle. Stock performance is just over 100 per cent lambing, 3.8kg wool/head and 90 per cent calving.

Our grazing management on Mt Dasher is quite intensive by some South Island hill country standards. On the oversown country, sheep and cattle are rotationally grazed in large mobs for eight to nine months of the year. The exception is when the cows and ewes have young at foot.

Our stocking rates on oversown country average out at five s.u./ha or two s.u./ac. Grazing pressures of around 50 sheep/acre are obtained when the blocks are grazed, usually for a maximum of seven days per block.

There are 33 blocks on the oversown country, ranging from 40ha to 190ha, three Maku blocks and five native blocks. Sub-

division is by conventional seven-wire and four-wire electrics.

To have effective grazing management in our situation we need:

- (i) small blocks, preferably less than 60ha;
- (ii) large mobs of sheep, in excess of 6,000;
- (iii) quick, simple mustering, with minimum labour input;
- (iv) high performing, healthy sheep;
- (v) readily saleable produce;
- (vi) an all-grass system with no supplementary feeding.

In our development programme over the past few years, we have totally changed our farm environment compared with what it was as a native tussock run. Then, the sheep had access to large areas to browse over and had plenty of time in which to do it. With the advent of oversowing and topdressing, we gave them a lot more high quality feed and their performance improved.

With the pressures on the farm economy from national inflation and personal ambitions, we found we needed to run more, and better, sheep. To do this we needed to adopt an intensively controlled grazing system. This really put the pressure on our halfbred sheep. Suddenly we were jammed into large mobs on small blocks, hardly able to turn around and continually moving to another block. This was a total change in environment for the sheep, even the view had changed.

We now needed a sheep that would thrive under high mob densities and their inherent stock health problems. It must readily and quickly spread over steep broken country to ensure that *all* feed is eaten during the time on the block. This is vital if efficient utilisation of expensive feed is to be achieved.

Five years ago I thought that perhaps we

*Mount Dasher.

should look at a sheep other than the more traditional halfbred, something that was widely used on other areas of intensively farmed hill country. We have, since then, been purchasing Perendale breeding stock, and have closely monitored their performance and returns, as well as our likes and dislikes of them. It is not important what type of sheep one looks at, there are good and bad in all breeds. What matters is that you select one that fits the criteria I have already mentioned — an aggressive, healthy sheep suited to high mob densities and willing to graze steep, broken country.

In our situation at Mt Dasher, our halfbreds developed several shortcomings as we intensified our farming. Some of you may well be prepared to tolerate these, but I felt there had to be a better way. The problems we encountered with intensification were:

1. Footrot

Last year we spent some 120 man-days, 1000 litres of formalin, \$6,000 worth of vaccines and much sweat in attempting to control footrot. Over one dollar per head for the ewes and hoggets was the direct cost; losses in production from unhealthy sheep were in addition. Up to 30 per cent of the ewes required treatment. This year, with the use of expensive vaccines, we hope we have reduced it to around 10 per cent.

Losses in production from sheep with sore feet are severe. An almost total lack of mobility, especially on steep faces, means that infected sheep get submaintenance feeding. This has disastrous results on their bodyweight, and, if during lactation, on that of the lamb. Even after treatment these ewes take a long time to regain a productive bodyweight. Apart from the misery to the sheep, little can be more depressing than a mob of lame sheep.

In comparison, the crossbreds that are continually run with the halfbreds (apart from tupping) receive no vaccinations for footrot and have never had more than a 5 per cent infection rate. Also, those that do require treatment are easily cured and

appear far less physically affected. Changing to a crossbred ewe flock means that we are spending a lot less time and money on controlling footrot.

2. Grazing

The second problem we run into with intensification is to do with grazing. Our halfbred ewes still seem reluctant to spread evenly over the steep blocks, apparently preferring the view from the tops. After grazing a block, the top is eaten bare and is black with manure, while down at the bottom of the face, feed is in abundance.

During the winter rotation the halfbred ewes lose around 6kg in bodyweight. Perendales, run with them, gain 1–2kg over the same period. With a mob of 3,000 straight Perendale hoggets this year, we have noticed a marked difference in the grazing patterns on their blocks. For the first time, the blocks are getting an almost even graze. When the mobs are shifted, they need to be mustered from every corner, not just the top beats. This ability to spread over blocks may not be a problem on gentler contoured country, but on steeper, rough blocks that are the basis of our wintering, spreadability is important.

3. Hogget rearing

The third problem we encountered with intensification concerns hogget rearing. As no agricultural land is available, hogget rearing needs to be done on the hill. With increasing numbers of ewes, more ewe hoggets were required. To rear good halfbred two-tooths, a lot of saved winter blocks and a lot of drench time were required.

Our Perendale hoggets thrive on this system of regular shifts though the autumn and winter. For the spring and summer they go onto a four block rotation with weekly shifts. We find now that we can run more hoggets on the same area, still getting them to 50kg liveweight at tupping. This allows us more room for ewes on the over-sown country.

So our three main problems with intensification — footrot, grazing patterns and

hogget rearing — have been largely overcome, but at what cost?

Financial returns

With the Perendales we tend to lose per head income from wool, and gain per head income from meat and surplus stock sales. Our Perendales cost less to run than the halfbreds.

Weights per head for wool have differed less than one would expect. Over five years the largest gain to the halfbreds was one-third of a kilogram and the closest was even weights. Nett returns have never been more than \$2 per head advantage to the halfbreds. I should point out that our halfbred wool is not especially fine, but is in the 25 to 28 micron range.

On the meat side, over the last five years the Perendales have had a lambing percentage of between 105 per cent and 116 per cent, generally about 10 per cent ahead of the halfbreds. Lambs drafted off the mother at 12 weeks of age have been good. This year the Perendales sent 90 per cent away FOM, netting \$19 each. The remaining 10 per cent were shorn and killed after 10 weeks on grass at the homestead. The ability of these store lambs to finish on medium quality pastures is a big plus for Perendales. No stores need be sold unless the market is good.

The halfbred's lambing percentages have been between 102 per cent and 106 per cent. Generally, 75 per cent to 80 per cent of the lambs go FOM at 12 weeks of age. This year they averaged \$16.50 nett. The stores left behind finish more slowly and require more attention and feed.

As far as lamb production is concerned, the Perendale ewes are ahead of the halfbred ewes by \$2 to \$4.

There is no monetary loss in changing from halfbreds to Perendales in our situation. If we take into account the lower animal health costs and the fact that the drop in wool income is offset by the increase in lamb income, there is a monetary gain in the changeover.

Marketing

We should also consider the marketing advantages of crossbred stock. While the hill and high country has been rapidly increasing stock numbers, with more sale stock, the downlands are being transformed by irrigation and new farming techniques.

Our traditional halfbred markets have shrunk, while those for crossbreds are strong. With good crossbred stock you have the option of selling to any market, while those people prepared to pay good money for surplus halfbred ewes and lambs are not getting any more numerous.

Conclusion

In conclusion, few properties are the same. At Mt Dasher we have found that while halfbreds have a place in intensive farming, Perendales have a better one. I am certainly not crying down all fine woolled sheep in intensive farming. I believe that on some farms, once the environment has been changed, then a change in livestock will be of further benefit. It has taken us quite some time to get used to the idea, but in fact it is no more radical than oversowing or electric fencing.

With the cost of developing and maintaining hill country skyrocketing, the only way we hill and high country farmers can remain viable is to become more efficient, more intensive. The alternative is retrenchment, which once started spells disaster for the farmer and the nation. Not running halfbred ewes will not result in a drop in income, but crossbred ewes and hoggets can provide a vigorous, healthy flock, with low labour inputs, and high per head and per hectare returns.

Many of you will be starting to wonder why a farmer who is dropping out of halfbreds into Perendales and Merinos is here talking at a fine wool seminar. Perhaps it is because there is more to successful development than deciding on seed, fertiliser, fences and roads.

Merinos and intensive farming

R. S. Emmerson*

The Merino as the late Graham Hughes described it "is a hardy breed with good foraging ability and able to survive climatic, physical and nutritional adversities. It is alleged to have a poor carcase, small frame, low wool clip, low fertility and other ovine crimes but much of this is attributable to the poor and uncertain food supply it often receives throughout its life in the high country". He was also quick to point out that with good nutritional and management conditions it could be a very high producing animal.

Intensive farming is described as aiming at increased productiveness. My comments on Merinos and intensive farming will be mainly related to the Forest Range experience as I believe it demonstrates the value of the Merino, not only in a situation that is intensifying by traditional high country standards, but also that their performance and returns can be satisfactory under a developing and changing environment.

Physical description

Forest Range and an adjoining block total some 14,400 ha of Pastoral Lease in the northern extremities of the Lindis Valley. It is on the west side of State Highway 8 and ranges in altitude from 492m at the homestead to 1,902m at the highest point. Rainfall averages 650mm at the homestead rising considerably in the Breast Creek, Upper Lindis and Timaru Creek areas. I estimate the winters at 107 days with at least four falls of snow and severe frosts. The higher steepland soils are strongly leached and the yellow-grey earths in the mid altitude zone are fairly high in natural fertility. Soils of the rolling hills are similar to the steeplands but have suffered from

rabbits, burning and general erosion in the past. A small 189 ha property which has 120 ha of irrigation is also run with these blocks.

The Land Capability consists mainly of two classes, some 8,122 ha of Class VII and 4,864 ha of Class VI. Class VIII makes up 12 per cent of with the remainder in Classes III and IV.

Development policy

The development policy has been designed to efficiently utilise the lands capabilities with oversowing and topdressing, fencing and tracking. The entire area of 5,462 ha of Forest Range has been oversown and topdressed in the last 11 years giving a nett gain of 7,632 stock units. In the last 12 months of grazing the area that has supported this stock load has averaged out at 2.4 stock units/ha, or a 400 per cent increase on its performance in the native state. The initial fertiliser application on areas to 914 metres has been 250kg/ha of Moly. S.S. 400 and on the higher areas in the last two seasons 375kg of Moly. S.S. 200 in two dressings. Maintenance is 250kg/ha of S.S. 200 every three years. Today the seed mix consists of 2kg of white clover, 3kg alsike and 2kg cocksfoot/ha. The legumes are pelleted and triple inoculated. Ideally the initial 250kg of fertiliser is flown on in the autumn prior to oversowing. This overcomes any spring problems of hauling fertiliser onto airstrips and any additional initial fertiliser can be applied when convenient at a later date. The timing of seed is simply a matter of judgement for each block, taking into account the aspect and altitude but aiming for optimum soil temperatures and moisture. Good results have been obtained from August sowing to November sowings at

*Forest Range.

higher altitudes. I have found that it is important not to graze the newly oversown areas in the first season from germination until the dormant period the following autumn.

Fencing

Of the 86km of new fencing in Forest Range some 70km consists of permanent electric fences. These structures consist of a waratah placed every seven metres with seven 12½ gauge high tensile wires, four that are earthed and three live. Insulators are three inch pieces of high density polythene pipe. These are wired onto the top of the waratah and then alternately down to leave two earth wires at the bottom, one of which acts as a return to the mains operated unit. Porcelain insulators are used at strain assemblies. Strainers are placed at around 6–700 metres. Fourteen-foot gateways have proved to be adequate. Fences cost \$2 per metre erected.

Electric fencing was originally regarded as a temporary measure to provide more subdivision at a reduced cost but has proved so successful that it will remain the standard type of fence for the duration of the development programme.

The criteria for subdivision has been based on the land capability in the low, mid and high altitude ranges with equal concern for the dark, shady and sunny aspects of the land. In general the fencelines have followed the ridges and gullies where erection has been a simple matter. Electric fencing has also been used to construct lanes with extra strength being provided at pressure points such as gateways or narrow sections.

Access

Tracks have been extremely important for quick access and these have been strategically placed for mustering, fence maintenance and mobility.

Airstrips have been placed at high altitudes — 1,158m and 975m respectively. The roads are capable of taking truck and

trailer units and the altitude of the strips reduced the high climb required, by aircraft, for sowing super-phosphate.

Stock handling yards, casual accommodation and wool sheds have been upgraded as stock numbers have increased.

Stock

The production policy has been on of maximising land use with known technology consistent with recognised conservation practices. It involves a livestock enterprise mainly producing fine wools in the 19–21 micron range with the aim of weaning and preparing surplus lambs to export quality or to retain and dispose of them on the two-tooth store market the following season. A small herd of cows and weaners are run for weed control in river beds and gullies and to keep in touch with the realities of the beef market. The proposed stock at June 30th on the three blocks is as follows:

| | | |
|--------|------------|---------------------|
| | 9,225 | Merino B. Ewes |
| | 775 | B×Merino Ewes |
| | 4,700 | M.S. Merino Hoggets |
| | 900 | B×E Hoggets |
| | 400 | Rams and others |
| | <hr/> | |
| 16,000 | 100 | Hereford Cows |
| | 90 | M.S. weaners |
| | 3 | Bulls |
| | <hr/> | |
| | 193 | |
| 15,272 | Total S.U. | |

The breakdown of carrying capacities of the three blocks for the last 12 months is as follows:

| | | S.U. | | S.U. |
|--------------|------|----------------|------|--------|
| Forest Range | 1969 | 2,340 | 1982 | 9,972 |
| Tomich | 1976 | 600 | 1982 | 1,600 |
| Breast Hill | 1979 | 2,366 | 1982 | 3,700 |
| | | 5,306 | | 15,272 |
| | | Net Gain 9,866 | | |

Of the 15,272 S.U. almost 13,000 S.U. are fine woolled Merinos and, apart from the 2,350 wether hoggets, all are female

animals. As far as I can ascertain Forest Range has always run Merinos, the flock being a traditional one when I took it over, with a balanced structure of ewes, wethers and hoggets for replacements. With extensive grazing, few blocks and poor nutrition the ewes were naturally low performers barely capable of breeding sufficient stock for replacing annual draft lines and compensating for natural deaths. Culling was almost impossible.

With the advent of fertiliser, white clover, wire and waratahs it was possible to exploit the virtues of the Merino. A convincing reason for persevering with them was obvious in the early years of development when they handled the severe winter of 1972 and clipped 4.5 kilograms of wool the following January. This wool netted 273c a kilogram. Their lambing performance was low but this was an obvious consequence of low body weights. As nutrition has improved so have liveweights and lambing percentages although there is tremendous scope for future gains. The three year average is 86.5 per cent. Improving the lambing percentage would be a logical step for the consolidation phase of the operation. Likewise the wool weights have shown an increase on average of about half a kilogram or $11\frac{1}{2}$ per cent over the 12 year period.

Although the Merino is basically regarded as a wool breed it was during the 1970s that I directed a lot of attention to producing an export lamb from the straight Merino and by also using the Border Leicester as a terminal sire across the two-tooth ewes and any undesirable mixed aged ewes.

By using the Border over the two-tooths I found an advantage of 10 or 15 per cent lambing was possible. The ewe lambs initially fetched a premium on the store market and in recent years have been the basis of a halfbred flock on the irrigated blocks at Tarras.

The wether lambs fattened sooner than their Merino counterparts but had not always been that far ahead of the Merino

on the killing sheets. An obvious advantage has been the reduction of penalites on seed and ribby pelts with the Border-cross. By crossing the Border over the undesirable ewes I am effectively culling or terminating any potential faults in the basic breeding flock. It would be debatable under a developing situation, where stock numbers are increasing, if the extra lambing and marginal returns were justified from the Border as it reduces the number of purebred Merinos available for the main flock.

The way the market forces are operating today with a demand for leaner animals for the export trade, the Merino, or its cross-breds run under vastly improved conditions, should be in an attractive position to meet the demand. By concentrating on the pure Merino for the export it market it was possible to finish wether lambs at around 12 kilograms at 14 weeks of age. In 1980, 50 per cent went prime off their mothers.

Since then I have retained all wether lambs, wintered and shorn them and disposed of them on the wether two-tooth market in February. Average sales were \$22.50 per head and the wool averaged \$18 per head. This move is to increase stock numbers on an annual basis without buying in stock, and has the added attraction of by-passing the problems associated with the freezing industry. It is also possible to increase the returns from the premium hogget wool market and it retains good wool producing animals for the industry.

Disposing of old ewes was a concern, with an average price of \$3.05 this current year for the majority of them. The solution for the remainder was a large hole in the ground.

Assessing this current season's gross income and relating it to the stock units carried at June 30, 1981, the gross return per stock unit was \$26.02. The value of stock increase of 1,137 S.U. have not been included in this figure.

Stock management

To capitalise on the investment in seed, super, fencing and tracking, and to extract a profitable return from livestock, the following system for stock management has evolved. It takes into account the changing requirements of the animals during the year and gives positive control over pasture development and feed utilisation with the use of mob-stocking and rotational grazing of Merinos.

To illustrate these points the following annual programme has been developed: Starting in mid-April the main mob of 6,000 mixed aged ewes are brought off the high altitude native blocks to a mid altitude block of developed country. This is the prelude to flushing which takes place from 1 May when the rams are joined with the ewes. At this stage a sample of 30 ewes are weighed to assess their body-weights and a decision made on the requirements of the ewes to achieve satisfactory body weights by the end of tupping, some 34 days later. This may mean moving the mob faster through a rotation during this period to gain body weights rapidly, or it may mean holding them and conserve blocks for a pre-lambing boost in late winter or early spring.

Two thousand two-tooth ewes are tupped separately and are combined with the mixed age ewes in the first week of June when the rams are removed. Their management from then on is identical to that of the older ewes. During May and June the blocks in the mid-altitude range are grazed out with the shadier ones taking the punishment first and then sunnier ones as the winter progresses. Severe frosting of these areas takes place at this time and it is during the nor-westers and mild spells that shady sides can be utilised. Average snowfalls are similar to frosting — requiring a similar management solution. Heavy falls have yet to be experienced under this system but I am confident that, with relatively easy access with ground machines, large mobs on small areas should be reasonably easy to reach. The time spent on these

140 ha blocks averages a week, but may vary from 10 days on some, to 4–5 on others, depending on feed and weather conditions at the time. As crutching takes place during July the rotation has been organised to have the main mob of ewes close to the shearing shed and it only requires an hour or so to run a cut of ewes into the shed. Likewise, when completed, they only have a short run back to a fresh block to continue the winter rotation. At least 16 blocks are required for this period, all of which have been saved since mid-January and all fall in the mid and low altitude and sunny aspect categories.

The feed requirements of ewes can be, and are, manipulated to suit the tupping, mid-winter maintenance, and pre-lambing boost period simply by speeding or retarding the rotation and selecting blocks that have the quantity or quality of feed that is required for that particular stage.

The mid-winter maintenance period gives a good opportunity to thrash a particular block without undue harm to the stock. The intense stocking pressure also gives an overall fertility build-up that acts as a spring tonic when the ground temperature rises in the August/September period.

Continuity of feed

The diet of the ewe over the winter period is virtually unchanged. This I think is very important for a ruminant as the adjusting and readjusting under supplementary feeding systems can be time consuming and detrimental to production. In early to mid-September the ewes are pre-lamb drenched and spread over all the oversown and topdressed areas at a stocking rate that averages one to the acre, but varies considerably depending on the block, its aspect, and its altitude. Some block to block adjustments are made during this period but with past experience these are kept to a minimum.

Lambing commences about the last week in September, and no shepherding is practised at all. The ewes are left entirely to their own devices and are only inspected

on the odd excursion when salt is being distributed. During this period when stocking rates per hectare are at their lowest their demand for extra feed is being satisfied with the onset of the spring growth. At this stage some of the lower blocks with sunnier aspects tend to accumulate a surplus of feed and are subsequently used for the first rotation of ewes and lambs. This takes place immediately after lamb marking in the second week of November and continues until weaning and shearing in mid-January. Lamb marking is done mainly on a block to block system, with portable yards. This minimises mis-mothering and the hassle of long droves to the main yards.

In the last two seasons ewe numbers per block have averaged about 1,200 plus lambs for the rotation. I have aimed to have four blocks for each mob, but in the last two seasons this has been reduced to three with one of these being spelled in late December or early January in much the same way as a down-country property that would close up a paddock for hay. The movement of ewes and lambs at this stage presents few problems as the ewes with their previous experience of being moved regularly are educated to the point where they are convinced that the grass is indeed greener on the other side of the fence, and usually co-operate by moving freely.

The first shift is no place for the keen young huntaway but the exercise of putting them through the gate becomes a very routine practice with little bother. When the lamb marking is complete, attention is turned to the shearing of ewe and wether hoggets. This is towards the end of November or early December and is combined with dipping and drenching. They are then rotationally grazed on developed higher altitude blocks. Towards the middle of January the various rotations are planned to terminate as close to the shearing shed as possible. We then have a concentrated period of stock work with the weaning, drafting and drenching of lambs and the shearing of ewes. All stock are

dipped for fly and ked protection at this stage.

Weaned lambs are put on the best feed available. This is normally a newly over-sown and topdressed block in the mid-altitude area. With recent subdivision it should be possible to graze them on clean worm-free country until the late autumn when they are crutched and moved to a winter rotation on lower and warmer country. Mixed aged ewes are drenched at shearing and turned out onto native country until the autumn.

Effect of rotational grazing

The impact of rotational grazing is showing up in the sward with native fescue tussock taking the brunt of higher stocking loads. This however, is well compensated for with the steady build up of grasses such as Yorkshire fog, sweet vernal and Danthonia, along with cocksfoot which was introduced in earlier oversowing mixes. The legume component is also very high. Today the percentage of bare ground has been reduced significantly and this is reflected in the quantity and quality of the water flowing out of the developed areas.

Problems associated with Merinos

Footrot:

This disease has certainly played havoc with organised rotations and labour requirements and been responsible for lost production of Forest Range in the last 12 months. The policy to combat it is to isolate and dispose of all infected animals. This has meant destroying or selling 10 per cent of the total flock in the past year. A conscious effort is now made to have stock moving over clean areas after treatment at the yards, to have clean musters and maintain a high standard of general hygiene. I believe that the effort in the last 12 months has given us good control and, as the disease doesn't discriminate between breeds I can see no advantage in contemplating a change of breed.

Smothers:

As a free moving animal the potential for the Merino in rotational grazing is high. Extreme care is taken in siting of gateways, fences and lanes, and when moving stock. It is a must to be at the gateway to regulate the flow of stock when moving large mobs. In the spring of 1980 I lost almost 500 while mustering a mob on the hill. No reason existed for the first few sheep that went down while attempting to cross an innocent looking gully, but the following sheep kept running over the top to create a bridging effect. This could have occurred with 2,000 or 20,000 or any other breed for that matter, but it must highlight the caution necessary when intensifying a system.

Selection policy

The most productive gains in our Merinos have undoubtedly been due to the extra amount and quality of feed that they have received. It has been nutrition in the main that has given our Merinos the extra

20 per cent of lambs and the 11½ per cent extra wool per head, and it has allowed them to express their genetic potential. As a commercial producer the next logical step is obviously to build on this with sires and dams that are identified as being superior animals with the emphasis on finer wool. With the now well-established technique of micron assessment and yield testing the guess-work can be taken out of selecting for yield and fibre fineness. As the greatest influence on genetic improvement in the flock comes from the sire, 35 samples were random tested from the flock rams this season to establish if our selection, using eye appraisal, was giving us the rams in the 20 micron and finer bracket. The results were startling with the micron range within 18–24 and on average they were 1.2 micron stronger than desired. The same was experienced with selected two-tooth ewes. Only 50 per cent of these tested actually fell in the 18–20 micron range and the range was 18 to 24.

Animal health aspects associated with intensive management of fine wool breeds

A. J. Jopp*

Introduction

The production capacity of any flock is a function of the following three parameters:

- The genetic base of the flock.
- Management.
- Nutrition and disease status of the flock.

The preceding two topics have been discussed by previous speakers. This paper will examine the aspects of the latter, particularly as they relate to intensive management of fine wool sheep. For convenience these will be discussed under the following headings.

- Nutrition and intensive management systems.
- Animal health and intensive systems
 - Disease encountered with intensification of any breed.
 - Footrot and fine wool breeds.

Nutrition and intensive management systems

Controlled grazing systems have now become an accepted management routine for many sheep flocks throughout the country, particularly during winter. They are recognised to have a dramatic effect on pasture control and utilisation, and to a lesser extent, stock health.

Attempts to adapt these systems to high country properties have highlighted a number of important features for property owners to consider before embarking on such programmes. These are as follows:

- Adequate subdivision is required. (At least 30 blocks).
- Weekly shifts with stocking rate of greater than 50 ewes/ha are required.
- Guaranteed and adequate rainfall for pasture growth.

Associated with the acceptance of these techniques has been the emergence of several nutritional problems which are exacerbated by intensive all-grass wintering systems.

- Starvation. The "Stuff and Starve" approach to feeding by rotation (particularly three day plus shifts) means some ewes will constitutionally "pack up". Affected ewes should be drafted off and set stocked or rotated ahead of the main mob.
- Sleepy sickness (Pregnancy Toxemia). This occurs within six weeks of lambing if ewes are subjected to stress and/or inadequate feed supplies. It can also occur post-lambing if the onset of spring growth does not coincide with the peak of lactation.
- Milk fever occurs in late pregnancy usually as a result of moving to new blocks or associated with pre-lamb shearing. Administer calcium borogluconate.

Animal health and intensive management systems

Generally more intensive sheep systems go hand in hand with an increased animal health input. This input can be considered in two ways. Firstly there is a greater requirement for particular animal remedies such as drench, dips and vaccines. Secondly

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there are increased consultations between veterinarian and farmer, trouble-shooting particular problems that occur on a day-to-day basis.

There are tremendous production advantages arising from the adoption of intensive management techniques. The increased input will be more than off-set by increased returns if the animal remedies are used with the correct professional advice. This is, however, a particular hurdle runholders embarking on such systems find difficult to adapt to. This is largely due to the fact that stock health under traditional high country management has been good — a result of harsh climate and low stocking rates.

Disease encountered with intensification of any breed

1. Internal parasites.

Internal parasites deplete appetite, milk production, wool growth and increase wool tenderness by up to 20 per cent, and reduce live-weight gains by up to 40 per cent. No across the board recommendations can be made about internal parasites as management varies between farms, however the following guidelines are offered.

- If in doubt about the parasite status of your flock consult a veterinarian. Faecal egg counts from dung samples (10–20) will indicate the level of infection.
- Use the same class of drench on the same class of stock for one year.
- Resistance, practically, is not a problem yet.
- Use the most effective drench for lambs and hoggets.
- Use the cheapest drench for ewes and wethers
- Ewe drenching. 1–2 drenches per year are sufficient. Used either pre-mating, pre-lambing, at tailing time or after weaning.
- Lambs and Hoggets — 4 weekly from weaning. Attempt to provide spelled blocks. (Two months.)
- Wethers do respond to drenching.

2. Infectious diseases.

Under normal conditions, a delicate balance exists between the agent, the environment and the sheep. If the balance is tipped in favour of the organism, (e.g. increasing stock density, nutritional stress etc.) disease is more likely to occur. Important diseases which have severe production limiting effects are Clostridial diseases (pulpy kidney-Tetanus, Blood poisonings etc), Pleurisy, Pneumonia, Johnes disease, abortions, Scabby mouth, ram infertility, (Brucellosis) and feet disease (see later).

3. Trace Elements.

These are of topical interest but in the main are not as important as many farmers think — Selenium being the exception. Selenium responsive conditions are well documented and its use is widespread.

Goitre (Iodine deficiency) can occur, but is usually the result of feeding brassica crops to ewes in late pregnancy.

If you are concerned about the disease status on your property, consult a veterinarian in sheep practise to ensure a correct diagnosis is made.

Footrot and fine wool breeds

Footrot is undoubtedly the number one animal health problem in most fine woolled flocks. Runholders are only too well aware of the debilitating effect of footrot, particularly in respect of Merinos and halfbreds. The result has been the development of the two tier farming system on many properties, i.e. Fine wool sheep run on hill country, crossbreds on improved country.

In 1948 Mr Geoff Fethers, B.V.Sc., wrote in the Australian Pastoral Review, "Since the germ that causes footrot was found and studied in 1941, little progress has been made in eradicating the disease from our flocks." He goes on to say, "It has been difficult to convince some practical sheep men that footrot is strictly infectious, and does not live in the soil."

The rural veterinarian in sheep practise is only too well aware that many of the sentiments voiced 30 years ago, still hold true today. The reasons for the lack of progress can be summarised as follows:

- Footrot is a complex, chronic disease. Control programmes must be planned and executed with the precision of a military operation over an extended period.
- Farmers' ability varies, as does the desire to eradicate, control or live with footrot. Most work is done on stop-gap measures rather than long-term planning. Also, the actual work is often delegated to staff who may not have the desire, knowledge or expertise to carry out a successful programme.
- Currently, most paring and troughing is done in such a way as to severely reduce its effectiveness.
- Boundary fences are not stock-proof. Areas where there are large annual movements of stock are difficult to adequately quarantine and check.
- Seasonal influences materially affect the prevalence of the disease. Good seasons are good for footrot. This is essentially moisture and temperature related. Good growing seasons mean more grass which will enhance the spread of scald, which may lead to footrot.
- Lack of extension services and communication between scientists, veterinarians, and farmers as to what is required in control and how practical and possible it is to implement on properties.

Despite the overall lack of progress in eradication as highlighted above, there is no doubt that footrot can be controlled, and, indeed, eradicated on individual properties using existing control measures. Many farmers achieve a good level of control but do not go the extra step to achieve eradication. The ultimate in control is to possess a disease-free flock where sheep

badly affected are culled annually. No other control measures are used. This is largely the situation existing in crossbred flocks within the North Island. Unfortunately, the degree of resistance to footrot in fine wool sheep is not great, and farmers who accept "control only" measures will be subject to explosive outbreaks occurring concurrently with favourable environmental conditions. For this reason, together with economic and practical considerations, eradication should still be the ultimate goal. To achieve this in the practical situation the following points are important:

- A long term preventative approach — There should be a plan of attack on a yearly basis, not on a strategic basis, i.e. as the need arises.
- A rigorous, determined approach and a real desire to control the disease.
- Each property requires a different blend of control measures to suit management practice.
- Priorities on most properties include the adoption of suitable facilities for treatment and control
- The rural veterinarian in sheep practise plays an important role in planning, demonstrating and advising on control measures.

Conclusion

It is concluded that animal health problems associated with intensification of fine wool breeds will not be limiting given the correct approach.

Vaccination programmes together with other preventative measures, will control most diseases commonly encountered in intensive sheep systems.

It is acknowledged that while footrot is a particular problem with fine wool sheep it can be controlled, and indeed eradicated, given the correct approach.

The processing of fine wools

K. Jowsey*

In order to understand the methods of processing it is necessary to consider the products in which fine wools are used and the properties of these wools. Both these factors have a major bearing on the various processing systems used.

Fibre properties

The major properties of the wool fibre which influence its use are:

1. Moisture absorption — Wool has the highest regain of all fibres. It can hold up to 30 per cent of its weight in water without feeling wet. It has also been shown that wool clothing on absorbing water vapour gives off heat.
2. Mechanical properties — While not as strong as many other fibres wool is very elastic and thus wool garments hold their shape well. It is also reasonably resistant to wear and abrasion.
3. Stiffness — The wool fibre is very flexible which enables wool clothing to drape well.
4. Felting Potential — Wool fibres will felt due to the action of moisture and friction. This property is very useful and widely used in making many woollen cloths; it can be a serious disadvantage in the wear life of certain products.
5. Flammability — Wool does not support combustion readily and is a very safe fibre compared with many others.
6. Dyeability — Wool is a relatively easy fibre to dye.

Fine wools of course have the added advantage of being finer in diameter (26–18 microns) which gives the products made from them a softer feel and enables finer yarns and consequently lighter garments to be made from them.

Uses

The above properties influence the products which are made from fine wools — these are:

1. Womens-wear — Coatings, dresses, suits and skirts which are mainly woollen fabrics.
2. Mens-wear — Suits, trousers and jackets which are mainly worsted fabrics.
3. Knitwear (both sexes) — Sweaters, underwear, socks, hats and gloves which are worsted and woollen.
4. Non-apparel — Blankets, rugs, upholstery fabrics and drapes which are mainly woollen fabrics.

Process methods

I should mention that the two major spinning systems used to convert wool into yarn are worsted, which uses longer combed fibres aligned roughly parallel and woollen which uses shorter fibres arranged more or less randomly in the yarn (can use reclaimed fibres as well as virgin wool).

The beginning of all textile processing is scouring. Wool contains impurities such as wool grease, dirt, suint, dung etc., which have to be removed. This is done by feeding through four or five wash bowls which contain hot water and detergent in the first three bowls and warm water in the others. The waste liquor containing the impurities passes through a settling tank where the heavy solids are separated from the liquor containing wool grease. The latter is run through a separator and some of the wool grease removed. Fine wools contain up to 14 per cent of wool grease and a similar amount of suint (soluble potassium salts). Scouring systems in general remove less than half the impurities from the waste scouring liquor and the disposal of this scouring effluent is causing grave concern

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to many processors. The clean scoured wool is dried then processed on either the worsted or woollen systems.

The worsted system has a long processing route and produces a yarn, as previously mentioned, in which the fibres are in a somewhat parallel formation. With the use of this system it is possible to spin fine yarns and from these make light and smooth-handling fabrics. Hand knitting yarns are also generally made on the worsted system as the yarn is more elastic than are equivalent woollen spun products and the relatively loosely knit garments will retain their shape better.

The first stage is top making in which the clean scoured wool is first carded to complete the disentanglement of the locks, mix the fibres and produce a uniform sheet or web of fibre. This is achieved by feeding the wool from a hopper onto a feed sheet and into a series of rollers covered with card wire (closely arranged, sharp ended hard steel wires suitably angled to project from a backing of hard material). These rollers are grouped around a similar clothed large cylinder or swift. The wool is carried round the swift where it is carded by the wire of the slower moving rollers. The final two rollers (which are the fancy and the doffer) lift the fibres out of the wire of the swift and transfer the web to the doffer from which it is removed by a doffing comb or blade.

Following carding, the sliver (condensed web of fibres) is passed through three gilling operations in which the slivers are blended and the fibres straightened by passing them through intersecting pinbars or combs. The output rollers can be adjusted to run up to ten times faster than the input rollers thus as well as blending, drafting or drawing out can take place.

After the third gill the sliver is fed into a comb to remove very short fibres, further straighten the retained fibres and remove vegetable matter. The long fibres are retained and made into comb sliver whereas the shorter fibres are rejected in a fibrous mass and known as noils. This by-product

is a major raw material in the woollen spinning system which can handle shorter fibres. Combing is achieved by drawing the fibres intermittently through a set of pins and leaving a fringe of fibres free to be combed by a revolving wire covered roller. This roller removes the short fibres and the longer ones are drawn in tufts by a pair of rollers through a funnel to be formed into a round sliver. The combed sliver is given two further gillings to convert it into a top.

Tops may be either processed directly into yarn or dyed and further processed. If heather type mixtures or marls are required it is necessary to dye in top form. Following top dyeing the dyed top is passed through a backwash where surplus dyes are washed off and the tops dried. It then passes through a number of gilling operations similar to those used in top making to reblend the dyed fibres and further straighten them. It may also be combed. The top is then spun into a yarn. This requires three further gillings in which further blending takes place and the sliver weight gradually reduced.

The final operation before spinning is roving in which the sliver is further reduced in weight and wound onto a bobbin in order that it can be drawn off for spinning. The spinning operation consists of drawing out the final rope of fibres to the required thickness and inserting twist to the yarn by revolving the end and then winding onto a bobbin.

After spinning, the yarn is wound to remove any imperfections by passing it through yarn cleaners which cut out any thick lengths. It is usually twisted into a two-fold structure for machine knitting and weaving yarns and up to three- or four-fold structure for hand knitting yarns. The level of twist applied to the yarn depends on what its end use will be; knitting yarns are given lower twists than weaving yarns.

In the woollen process the wool fibres are often dyed following scouring. They will then be blended and oiled. The shorter

fibres used on this system require the addition of fibre lubricants to hold them together and reduce the waste levels. The dyed blends are then carded in a similar manner to that of worsted yarn but the woollen card is twice as long. It takes the web from the first part of the card and turns it at right angles feeding it into the second part which is similar to the first except that it has a finer gauge of pinning on the rollers. The web of fibres emerging from the card is split by tapes into a number of fine ribbons of fibres which are consolidated by a rubbing action and wound onto bobbins. These bobbins are placed on the spinning frame which slightly draws out the yarn, only a small amount of draft can be used because of the random orientation of the fibres. In many instances woollen spun yarns are used in the single form without twisting but if plied yarns are required for upholstery fabric or carpet yarns for example, then a twisting stage will follow. The woollen system is a much shorter process route in which the carding machine is the most important process step. It can use shorter and lower cost fibres but it is not capable of spinning very fine, even, yarns.

Yarns for the woollen and worsted system are used in a variety of fabrics. Woollen yarns are generally used in heavier fabrics and in ladies' wear, whereas worsted yarns are used in menswear and lighter fabrics. This is a very general comment and not true in all cases but it is impossible to manufacture very light, serviceable, fabrics from woollen spun yarns.

The first stage in cloth manufacture is warping, in which a large number of yarns

are wound onto a beam in the desired colour pattern and length. The warp is then drawn into a loom and each end is threaded through a wire heald which is connected to a framework or shaft. The way the yarn is drawn in depends on the type of weave required.

The length ways threads in the cloth are referred to as warp and the widthways as weft. In these days most modern weaving machines feed the weft yarn in from a large package of yarn rather than winding small packages to fit in the shuttle. After the weaving stage the cloth is finished to give it the desired appearance and handle dependent on its end use.

Woollen fabrics are generally woven quite slackly in the loom but milled to the required thickness and density. In contrast most worsted fabrics are densely woven and little milling is required.

The various finishing stages include mending, where any weaving faults and extraneous matter is removed. Washing the fabric to remove soil, stains and process lubricant. Milling to consolidate and thicken the fabric, cropping to reduce the surface pile fibres and raising to give a long pile effect as in blankets and coating and finally pressing and rolling. The finish applied to the fabric depends on its end use. A billiard cloth which is a finely woven woollen cloth is very heavily milled and cropped to give a very firm even fabric. A blanket fabric on the other hand although milled is heavily raised to provide a cloth with good insulation value.

Fundamental requirements for effective clip preparation

B. M. Tinnock*

Within the present structure of our wool-selling system, guaranteed product description follows pre-sale sampling and laboratory testing of suitable farm-classed lines. Such offerings include an increasingly large proportion of the fine wool component of our national clip.

Since the implementation of Sale-by-Sample, efficient preparation of the fine wool clip at shearing time is of even more significance than in the past. Furthermore, I believe that good clip preparation is now a more rewarding exercise than before, in terms of both professional satisfaction to the wool-classer and of long term monetary realisation to the grower. Guaranteed test results now substantiate the wool-classer's hand and eye appraisal and engender buyer confidence at the point of valuation prior to sale. Measurement results published in the broker's catalogue provide growers and classers with a greater understanding of the sort of wool grown and of prices realised on a clean basis.

On-farm clip preparation is an integral part of an overall system designed to achieve cost saving efficiencies for producers, brokers and buyers. To derive maximum benefit from modern wool-selling methods, growers must recognise some fundamental requirements for good clip preparation and, more importantly, must put them into practice. These requirements are:

- prevention of pen-staining of sheep;
- maintenance of good shed facilities;
- provision of adequate shed labour;
- employment of a qualified wool-classer;
- good communication with the broker.

There is nothing new about these recommendations and most farmers would acknowledge their desirability, but with current emphasis on the increasing importance of on-farm clip preparation, a more positive attitude is necessary. It is both prudent and timely for growers to consider whether their policy in past years has been to adopt only some of these requirements, or if they have customarily insisted upon all of them.

Wool preparation should commence before the sheep enter the shed for shearing. They should first be allowed to stand in a bare paddock or yards for sufficient time to "empty out" in order to prevent their fleeces becoming pen-stained. For the same reason, dagging must be done where appropriate before "shedding up". Covered yards are also an area where pen-staining will occur if provision has not been made for sheep to "empty out" before entering them.

Pen-stained wools may be discounted in price. This is because certain water-soluble pigments contained in the dung act as dyes on to the fibre during wool scouring. The resultant taint colours, being light-sensitive, may change when exposed to sunlight, thereby causing variation in the shade of the finished fabric. Excessively pen-stained wools are not eligible for Sale-by-Sample, while lines of pen-stained wool are required to be noted as such in the broker's catalogue. It is in the grower's own interest to take the simple precautions to ensure that this fault will not occur.

Good shearing shed facilities can do much to increase the congeniality and thereby the efficiency of the shearing and wool-handling operations. Shearing shed design has seen many advancements in the

last decade or so. Modern ideas can be incorporated in the design and construction of new sheds, or in the renovation of old ones. This has, in fact, become a specialised area, and final individual plans will depend on a number of factors beyond the scope of this discussion. Two features, however, should be high on the priority list:

- good lighting over the shearing and wool-handling areas, and particularly over the wool-rolling and classing table; and
- well-positioned wool-handling facilities, fixed or portable, to provide for an efficient wool flow from shearing board to bale storage area without congestion at any point.

An adequate number of shed hands is an essential basic requirement for efficient clip preparation. It is one which is often sadly neglected, and particularly on properties where contract shearing gangs are employed. In past years a number of shearing contractors have affected cost savings for themselves by consistently fielding less shed hands than are required to do the job properly. This practice continues in some districts, to the detriment of clip preparation. One can readily appreciate that it is not an easy task for a contractor to find sufficient or suitable staff at the particular time he needs them. However, the grower is the loser when this situation is allowed to recur year after year, for it is he, and not the contractor, who suffers the penalty of lower prices for poorly prepared lines. In fairness to contractors it must also be stated that this situation sometimes occurs when a grower, seeking to reduce shearing costs, stipulates a maximum number of shed hands which is less than that needed for a quality job.

In “fast” sheds, where skilled shearers are consistently turning out high tallies, it is particularly important that there be sufficient table hands to ensure that:

- any skirting and back removal is done efficiently;
- accumulation of a large number of fleeces round the table will not occur;

- a regular flow of correctly prepared fleeces will pass from the shearing board to the classer’s bins.

Although skirting is basically a simple operation, the decision relating to the extent of skirting and back removal required in good style fine wools is a critical one. It is important to have sufficient table hands to implement this decision. Experienced table hands are not always easy to acquire. Where such is the case, a leading shed hand or similarly responsible person is a desirable and important element. This particularly applies in large or “fast” sheds, where the classer supervising all facets of the wool handling operation cannot reasonably be expected to oversee the skirting of every fleece.

I would suggest to growers that shearing contractors who undertake to provide staff for the wool-handling should be viewed in the context of being **shearing and wool-handling contractors**, and as such should be expected by the grower to provide a sufficient number of people to handle the clip preparation properly. The number of hands required will vary from shed to shed, depending on factors such as the speed of the shearers, the speed and ability of individual shed hands, the extent of skirting and back removal required and the type of wool press provided. All this should be well known to the grower from previous experience, and his insistence that a full team of shed hands arrive on the property at the commencement of shearing should be clearly understood by the shearing and wool-handling contractor.

The employment of a competent wool classer involves a person who, in addition to being conversant with classification factors in relation to trade requirements, is responsible for supervising all wool-handling procedures during the shearing operation. Broadly speaking, the wool-classer’s approach is to make as few lines as possible, consistent with the size of the flock and the variations of fineness, length, colour and other factors which appear in the clip at a particular shearing. These variations may

differ from year to year according to the environmental conditions experienced during the period of wool growth. Wool-classing is sometimes done to a high degree of efficiency by the wool grower or by a member of his family. It is more common though, to find on medium to larger properties that a person specialising in such work is employed. Such people have the opportunity through the New Zealand Classer Registration Scheme to provide evidence of having attained a recognised level of achievement in their work, and any classer worth his salt would take this voluntary step.

The Kiwi stencil containing the classer's registration number remains the property of the Wool Board, which administers the scheme. It may be recalled at any time should the classer's work not meet the required standards, which are constantly monitored by the Board's appraisers. We may therefore expect that no responsible registered shed classer would endanger his reputation by applying the Kiwi stencil to fleece lines which he has classed, but which have been inadequately prepared because of shortage of shed labour.

Advantages of employing registered shed classers for those growers who do not prepare their own wool are continuing to accrue. The Wool Board is providing more frequent refresher courses for registered classers to keep them abreast with current development and policies in various sectors of the trade. These include papers presented by wool brokers, buyers, processors and researchers. They provide a wealth of information for participants, many of whom attend these courses at considerable personal expense.

Registration is also offered to competent owner classers whose registered Kiwi stencil may then be applied to their own clips. Owner classer registration recognises a high standard achieved by the grower in the preparation of his wool for sale. It is also an indication to the buyer that the owner takes a special interest and pride in his clip. In recent years, the Wool Board

has expended considerable effort in encouraging more growers to qualify for registration as owner classers. This policy is highly commendable and should be continued.

Growers should also be aware of the short course conducted regularly by the Wool Board in which participants can qualify for a Woolhandler's Certificate. These courses are offered to people who have at least three years' practical experience in woolhandling and wish to take more responsibility in the woolshed to ensure good clip preparation. Such an attitude warrants encouragement and monetary reward. The scheme however, will be of little benefit to participants or the industry unless certification standards for woolhandlers are sufficiently high. I would strongly emphasise the significance of this point, particularly in regard to the handling of fine wools. The certificate should be recognised as being worth working towards. Many young woolhandlers will regard it as being the first step towards ultimate qualification as a woolclasser.

Preparation of wool for sale does not finish in the shearing shed. The bulk of the New Zealand clip is displayed by wool brokers to the trade for valuation prior to sale by auction. In order to retain cost efficiencies in this area, both wool growers and woolclassers have a firm responsibility to maintain good communication with the brokers. On arrival at a broker's store, the various bales comprising a classed clip must be channelled in either of four directions — for grab sampling, conventional show stacking, lot building or binning. It is therefore imperative that wool specifications reach the broker either before or at the time of delivery into store.

When viewed on the broker's show floor, the various lines of fleece and oddments will display the standard of your on-farm clip preparation. Here, you are presenting your product for appraisal by buyers who represent the world textile market. On average, it takes a wool-buyer about 20 to 30 seconds on the show floor to expertly

evaluate each lot. In relation to the twelve months it takes to grow your product, this is a very brief period of time in which to have its worth determined. Only appropriate organisation before, and efficient shed management during shearing, will ensure

that your clip is presented in its best form for this brief allocation of valuating time.

Time spent in maintaining good clip preparation is time well employed. In effect, it constitutes one of the most significant operations in the wool-grower's year.

Quality control of shearing and woolhandling

J. Street*

The most important factor for any fine wool farmer to consider at shearing time, is the quality or workmanship of the gang. All farmers are very much aware of the cost of the shearing operation but they may not be so informed about how much money a poor job can cost them.

Shearing

There are two things to consider when assessing the shearer's job. One is the "inside" job; that is the number of second cuts being made. Second is the "outside" job; that is the wool left on and the cuts on the sheep in the pen.

The cost of second cutting can be considerable. For example, a shearer making one per cent of second cuts is equivalent to 40g second cuts from a four kilogram fleece. If the price of a fleece is \$5/kg and the price of locks is \$2/kg, then there is a \$3/kg difference. If 40g of fleece cut into locks costs 12c/sheep, then a shearer making a two per cent second cuts costs 24c and so on. The farmer also gets a lower price for his fleece because it is of shorter or mixed length.

Outside, in the pen, the appearance of the sheep affects the sale of stud sheep. Cuts lead to infections and damage the pelt. There is an increasing number of lambs being shorn to remove seed before slaughter. In this case the lambs must be shorn absolutely clean for all the seed to drop out.

Woolhandling

The quality of the woolhandling has an appreciable effect on the sale of the wool. Shed hands can make expensive mistakes such as overskirting, especially pieces and necks, and moit left in the fleece downgrades it considerably. The wool classer has a responsibility to maximise profit for the farmer by good supervision of

woolhandling, especially skirting. He should make sure that the clip is attractively presented with good pressing, sewing and branding. It is his responsibility to supervise the packing of the bales into correct weights ready for freighting.

Well classed lines should be in good lot sizes. The amount of wool binned in store should be minimised. Pre-sale testing is advised when it is to the grower's advantage and the clip should be prepared accordingly. The fine wool selling centres advise that poor woolhandling, whether it be in skirting or classing can easily cause a price drop of 20c per kilogram and it could be considerably more than this. Therefore, on a 40kg fleece poor wool preparation can be costing around 80c per sheep.

Thus, if a poor shearer is costing the farmer around 20c a sheep and poor wool preparation is costing around 80c a sheep, a "rough" gang is costing the farmer one dollar per sheep or \$100 per 100. The farmer should therefore look hard at the quality of work each gang is putting out when he compares different contract prices. A contractor who pays well and regularly, and who supplies good food and quarters will attract good workers. An extra shedhand will cost more, but make more money for the farmer in the long term.

How to achieve high quality

The first thing to be done in tackling the problem is to identify the rough worker. There is a difference between the "don't knows" and the "don't want to knows". The "don't knows" are usually learners and can be educated. The "don't want to know's" are better out of the shed altogether.

The farmer should be acquainted with the difference between a good shearer and a poor shearer. Many farmers complain

*Alexandra.

about a rough job in the pen, but a rough job on the board actually costs them more money. The farmer should be familiar with the skirting standard required for his clip and watch that this is maintained. He should employ a Wool Board registered classer, or an experienced store classer, except on certain clips where a Lincoln or Massey trained student with a good reference may be an acceptable learner classer.

The number of shedhands in a gang is important. On pre-lamb fine wool far more shedhands are needed than on summer shorn crossbreds. For example, with three shearers shearing 6–7,000 sheep a day, four shedhands, (two table, one sweeper, one fleeco) plus a presser/penner-up will be needed, especially if moit is being removed, one shedhand per 150–175 fleeces/day is needed and the presser(s) will be in addition to this number. Later in the season, when wool is often poorer, fewer shedhands may be needed. The following table shows the cost to the farmer of one extra shedhand:

| | |
|-------------------------------|-------------|
| 1981–82 Season | \$ |
| \$6/hour for 8½ hours | 50.00 |
| Food | 6.00 |
| Accommodation plus rainy days | 5.00 |
| Accident Compensation Levy | 1.00 |
| Contractor's overheads: | |
| Phone, vehicles, stationery, | |
| administration, cooking gear | 4.00 |
| | <hr/> 66.00 |
| 10% | 6.60 |
| | <hr/> 72.60 |

Say 650 sheep/day

Cost=\$11.17 per 100

Certificated shed hands are entitled to 25c more per hour.

Therefore, a farmer should expect to pay anything from \$8–\$12/100 for an extra hand and to pay extra for experienced hands.

There are various points that should be borne in mind in order to get the best possible work out of a shearing gang. The first is for the farmer to specify his requirements **before** shearing begins and not afterwards.

He should always be fair in all his dealings with the gang and be encouraging and appreciative of good workers, as well as being critical of poor workers.

The farmer should be aware of:

- (a) staff new to the contractor;
- (b) seasonal staff shortages;
- (c) tough sheep;
- (d) gear — combs, (if providing special gear such as cover combs give them to the shearers in time to “do up”).
- (e) learners.

Good work needs good facilities, and it is the farmer's responsibility to see that these are provided and are in good working order; for example, grinders, plates, emerys, machines, suitable brooms, and a good light in which to work. The light should be blue or daylight and not the common yellow bulb or fluorescent.

If there is a quality problem the farmer must tell the ganger or contractor at the time, not six months later. He should check the facilities and food the contractor is providing, and also enquire as to whether the award is being paid and indeed, if the workers are being paid at all! Unfortunately there are many cases where these things are not up to standard and these contractors will get a bad reputation and good workers will avoid him.

Summary

Poor shed work can easily cost the farmer an extra \$100/100. Good shedwork requires good quality staff, the correct ratio of shedhands to shearers, and good facilities to carry out the work required. The farmer should expect to pay a higher price for the following:

| | |
|-----------------------------------|--------------|
| extra shedhand | \$8–\$12/100 |
| extra or better food, | |
| accommodation | \$3/100 |
| registered or experienced classer | \$3/100 |

There will be other costs in providing well maintained quarters and good shed facilities. The fine wool farmer who insists on a top quality job at shearing time, even if it costs him more, will be making money and gaining a good reputation for his clip.

Prospects for Merinos in the meat trade

A. E. Frazer*

Some fundamental changes in the factors affecting red meat consumption patterns have taken place in the past 20 years. Changes are largely occurring in Western style markets with relatively high levels of meat consumption but some are apparent in other countries. The significance of these changes on the future direction of red meat production and processing are probably not sufficiently appreciated by many involved in, and servicing, the industry.

These areas of change can be summarised as follows:

- Health and nutritional concerns.
- Changing life styles.
- Growth in availability of goods competing for disposable income.
- Changing methods of retailing and presentation of meat.

Health and nutritional concerns

In some more developed countries, there is a trend toward eating less red meat for dietary reasons. In spite of such recommendations being controversial, many people appear to have taken heed.

While not conceding that the increasing preference for lean meat has valid health grounds other than those seeking to avoid obesity, we need to recognise this happening. Certainly we must seek to counter unjustified claims and promote the merits of meat but we must also respond by presenting leaner red meat particularly as competing protein such as fish and poultry has much less fat.

Changing life styles

An increase in sedentary occupations combined with shorter working hours has resulted in a lesser demand for carbohydrate of which fat has been considered to be a most important source.

The working housewife has introduced a new dimension. This has resulted in a demand for convenience type meals that can be easily prepared and cooked quickly. There has also been an increase in the purchase of meals not prepared in the home. In addition, increased activities outside the home have meant people eat less often as a family, leading to a fall off in the eating of meals based around roasts and other large joints.

Growth in availability of goods competing for disposable income

There are signs that in some countries a negative income elasticity is developing with respect to consumption of some meat products. Reflecting this is an apparent increase in cost consciousness in relation to meat purchases and more attention being paid to avoidance of waste in meat, e.g. fat and bone.

Changing methods of retailing and presentation of meat

A growing proportion of meat sold to the consumer is through self service retail operations. This limits the retailers' scope for "pushing" a particular type of meat and also their ability to assist customers with advice on preparation and cooking methods for unfamiliar meat types and cuts. Decision-making on the meat purchase rests on the purchasers' sole judge-

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ment which increasingly focuses on comparative appearance and price.

This more competitive retail environment has been recognised by meat processors who endeavour to present their meat in a form that ensures retailers present it favourably. More and more meat and poultry is being pre-packaged and much in boneless form so avoiding the criticism of waste in the form of bone and excessive fat.

Running through all of the aspects of change discussed is a consumer aversion to fat. This is also evident in many non-western markets particularly in New Zealand's new outlets in the Middle East. Traditionally, these countries have preferred a relatively low fat diet with their requirements being based on vegetable oils.

This feature is of particular concern to New Zealand as not only is lamb regarded as fatty compared with beef and poultry, but also its fat is regarded as smelly and by many as being unpalatable when the meat is warm or cold. Further, the majority of lamb is still retailed in bone-in form with little or no trimming of fat, particularly so in the case of frozen lamb, while almost all beef and much pork is now being sold boneless or in trimmed bone-in form.

However, lamb is not alone in facing this problem. While Americans still eat more beef than any other meat, the gap is narrowing. In the last five years beef consumption has fallen 19 per cent while poultry consumption has increased 20 per cent. Consumer interest in reducing fat in diets is seen as a major reason; another is that inflationary pressures have kept beef prices higher than those of chicken and other meats.

Where grain is a major element in meat production, poultry and pork is winning hands down — it takes 36kg of grain to produce .454 grams of beef and less than 13kgs for .454 grams of chicken. Further, the poultry and pork industry have made big genetic improvements in improving growth rates and the meatiness of their stock and

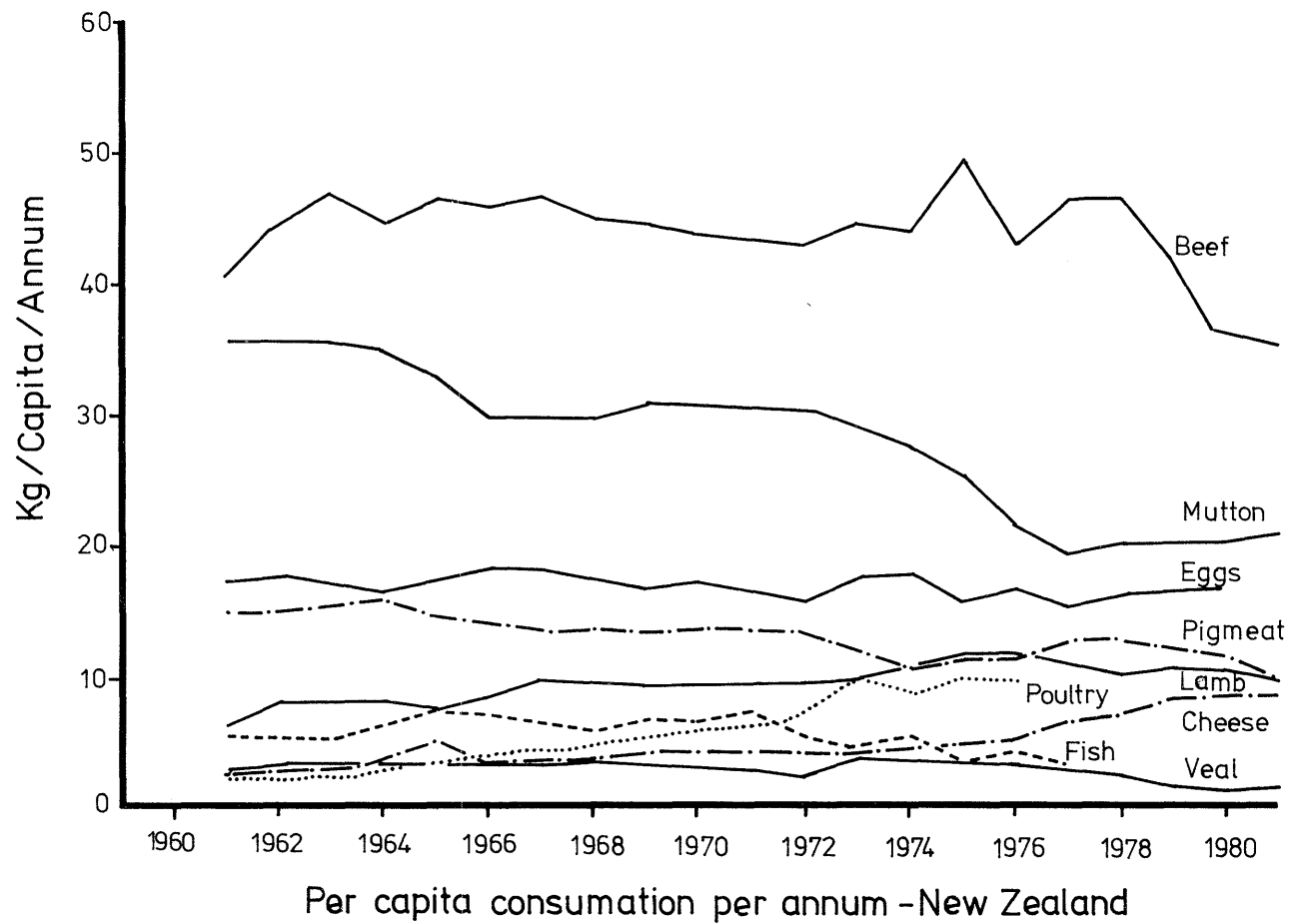
also the production systems are more efficient and integrated.

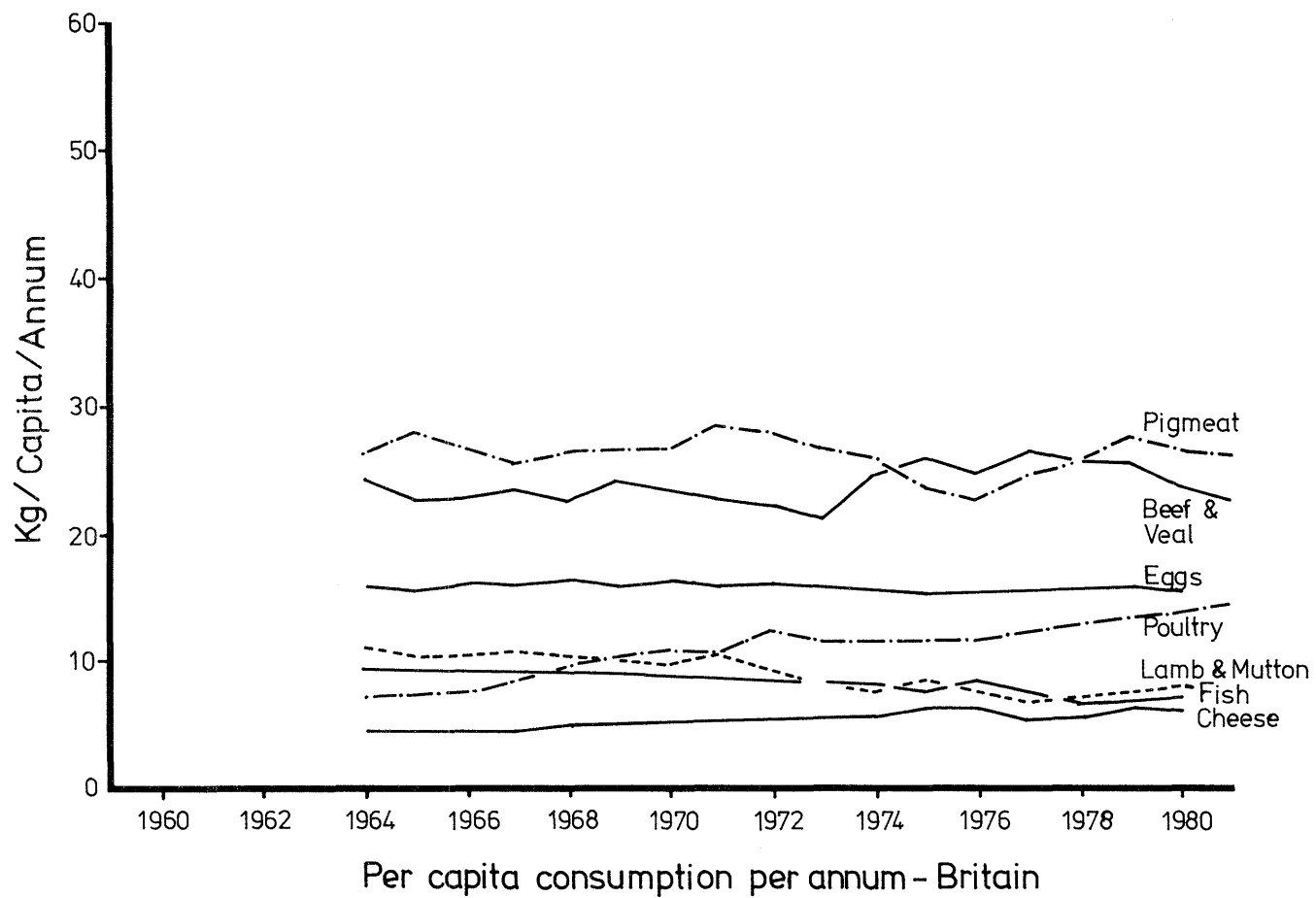
Reduction in fat and other measures that contribute to improved appearance at retail, along with steps to hold costs of production, processing and distribution in order to offer consumers competitive prices are the dominant messages that flow from consumers to producers of red meat generally.

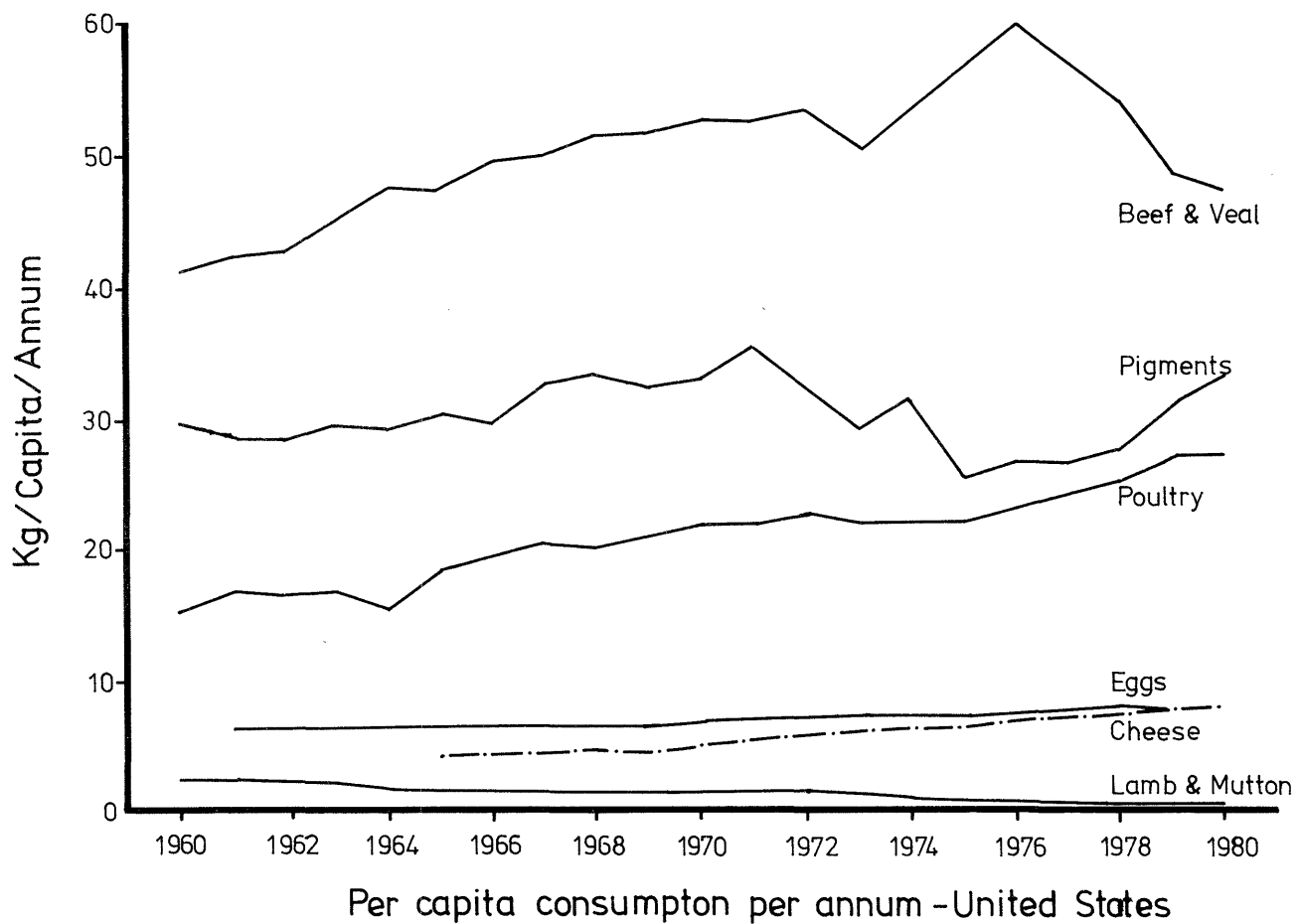
There is a particular need for us to understand consumer concerns about lamb. This is because of its importance in our export earnings — our largest major meat export item earning 14 per cent of all export income last year. Compared with our beef and mutton exports almost all of it is sold as an identified table meat which places stress on appearance at retail. In this respect, lamb is tending to become unique in western style markets as still being presented to consumers largely in bone-in untrimmed form. In addition, New Zealand lamb comprises by far the largest volume of any single red meat sold to consumers in frozen form, with its disadvantages — some perceived and some real — of straight out prejudice, less attractive appearance, toughness and lack of convenience.

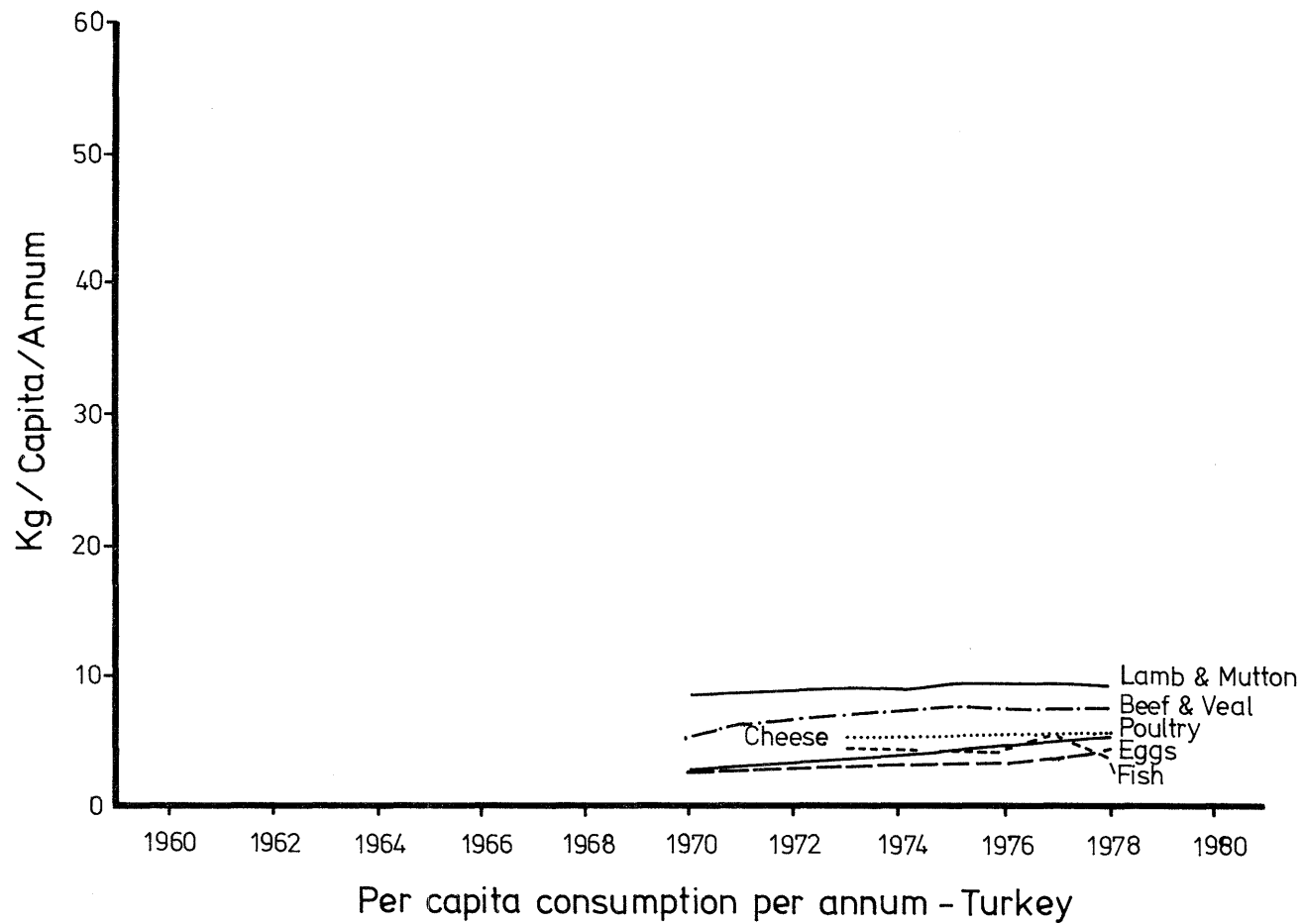
Fortunately, there does not seem to be much conflict in requirements between the various markets we seek to serve. The universal requirement is for lean meaty carcasses, and provided that is met, weight within broad limits is of lesser importance. Tenderness is also highly desired but the need for building this in prior to export does vary according to the final handling and cooking methods being used. Of course, many of our customers would prefer to have fresh meat instead of frozen, and in some cases because of prejudices against frozen meat as they incorrectly consider freezing either impairs eating "quality" or camouflages meat that has gone off in "quality" in the first place.

However, some major differences exist in meat eating habits, competition and









methods of presentation of meat that have to be considered in the form and manner in which we present our lamb for sale.

To become competitive in price, improve appearance at retail and provide ease of preparation and carving, one retailer of British lamb has called for a turkey processing style operation to hoist sheepmeat into the 20th century. He goes on to say:

“We need a consistent, guaranteed supply of lean, heavier lambs that can be well butchered, boned-out and rolled, to sell as an easy-carve roast. The breasts and flaps can go into manufacturing, the loins boned and rolled for roasting and slicing, to carve as easily as pork — so that you could have lamb rashers for breakfast. Lamb could be sold as a branded grocery item, which allays the cook’s feeling of guilt at using a convenience food; and it would still retail its name as the last of the natural meats: not battery produced, nor hormonised; grown on grass out of doors.”

The New Zealand meat processing industry, to its credit, has already ventured into developing new ways of presenting our lamb as a more attractive and versatile meat including boned and rolled roasts and boneless steaks. However, this approach is only in its infancy and much more initiative is required in this area. Further, there is an urgent need to find techniques that improve the red meat colour of retail packs of our frozen lamb, compared with that of fresh meat. Also to develop more moderately priced packaging film that prevents misting and ice formation which is a particular need for lightweight packs and packs of awkward shape such as chops.

While boning and cutting operations give an opportunity for trimming excessive fat, this is a costly approach compared with encouraging producers to avoid its incidence in the first place. Reduction of the fat content in the carcass must be the single most important facet of changing market requirements for New Zealand meat producers be they producers of lamb, beef or

mutton for consumption as a table meat or for use in manufacturing.

Reconsideration of slaughter weights is the other important message coming from the market. For all species killed for export, higher slaughter weights result in reduced per kilogram processing costs which must continue to be competitive in our pricing. Achievement of this for lamb will also result in carcasses highly suitable for boning and further processing operations and allow greater penetration of the catering trade. Further, it will largely overcome concerns about lack of meatiness that are sometimes directed at cuts from light weight carcasses. A degree of caution will, however, need to be exercised. In many lamb consuming countries, heavier weight carcasses sell at a discount because such carcasses tend to be fattier and with most countries not having a grading system, there is a prejudice against heavy weights, whether they are fat or not. If we process our heavy lambs past the carcass stage before export, this should not be a problem but if excessive price discounts are to be avoided for carcass sales, time will be needed to convince customers that our heavy carcasses are consistently graded to a sufficiently lean standard.

A reduction in fat content and an increase in weights, must be the key objectives for producers if they are to effectively contribute to maintaining New Zealand’s status as an export meat nation.

Other considerations such as meeting good conformational standards and attaining good muscle development are important but should not be seen to diminish the importance of the two key objectives of reduced fat and increased weight.

I hope this message reinforces the urgency which we need to give, in responding to change — both changes in demand and changes in the pricing and presentation of competing meats.

The Board has sometimes been accused of putting forward a compelling case for breeders and farmers to change breeding and management systems in order to pro-

duce leaner meat yet has done nothing to encourage farmers to respond. Farmers rightly constantly remind us that if there is money in it they will change. To some extent we have been in a cleft stick over this issue. While the Board through its control over the export grading system has introduced an overfat grade, many farmers escape the incentive to change which it imposes. In part, this is because graders, who to a large extent still grade subjectively, tend to err in the producers' favour. Also, many farmers escape the penalty either by selling on a per head basis or through exporters being prepared to take such stock at full schedule prices for throughput reasons. Those farmers living near big cities sell their overfat lambs on the local market where a grading system is completely out of touch with today's requirements, places little disincentive on the production of excessively fat lambs. In addition, the price signals the farmers are getting make it more attractive to take lambs to heavier weights and suffer the consequences of a proportion grading overfat. In Britain, some commentators are suggesting that overfat lambs should be disadvantaged to a greater extent than justified by market prices in order to protect the producers' long term interest. The time has come for us in New Zealand to discuss this.

The levels currently set for determining if a lamb is overfat are almost certainly too high in relation to current market demand. I estimate that around 25 per cent of our export lamb is currently too fat for the requirements of the British market which in turn is more fat tolerant than most other markets. We have been somewhat reluctant however to tighten up if breeders' and producers' only response is to reduce carcass weight. The discussions we have held with animal production and genetic experts, along with the development of probes for measuring fat depth in live animals, lead us to believe that increased leanness is possible. Further, this appears achievable without reducing weights or affecting growth rates, wool production and repro-

duction. British work suggests that the quickest path to improving leanness is to use later maturing meat breed sires. While New Zealand has a wide range of meat type breeds, numbers have declined in recent years thus reducing scope for rapid selection of desired traits. Further, it is unfortunate that we appear to have closed the doors to imports of other breeds such as the Texel which could play an important role. With the greater economic significance of wool in New Zealand, more use of later maturing meat breed sires is not going to be the complete answer anyway. Clearly we will also need to look at incorporating selection for leanness into breeding programmes for dual purpose sire breeds and possibly consider the contribution which existing genetic potential available in some of the minor breeds can contribute.

The fine wool breeds obviously fit into this category. I cannot claim to be an expert in the performance and genetic potential of these breeds. Indeed, it appears that very little scientific work has been done on the performance of the fine wool breeds as meat producers under New Zealand conditions.

A paper published in 1974 by Kirton and others does, however, provide some interesting information. Carcase assessments were made of lambs of the following breeds run on North Island hill country conditions: Romney, BL×R, Perendale, Corriedale and Merino.

The Merino was shown to be the slowest growing lamb, the leggiest breed and when compared at the same carcass weight, was, along with the Perendale the fattest carcass. However, the Merino had low subcutaneous fat. The Merino, compared with other breeds at the same carcass weight, had a superior eye muscle area once carcasses rose above 15kg but had the poorest palatability score. This was possibly due to leanness and the very light weight of the legs tasted. Obviously this is insufficient data on which to draw any conclusions but it does seem that the characteristics could perhaps be exploited in our breeding pro-

grammes. A word of warning, however. Our own grading supervisors comment that the Merino lamb carcase is leggy, has bare points but carries a heavy waistcoat of fat once weights increase above 12–15 kilograms. This observation relates to Merinos raised under South Island conditions and is based on observations of the greater volume of Merino lambs that were slaughtered a few years ago.

Merino cross Down lambs are regarded as very acceptable carcases provided they are not taken to heavy weights when they tend to excessive fatness. However, the relative low resistance of the Merino to footrot is no doubt a factor which limits the range of lowland finishing country on which cast for age Merino ewes can be run with a terminal sire. The free draining lighter soils of the Canterbury plains have been particularly suitable for this type of operation. In the same way the extensive tracts of light but finishing country in Australia has been particularly suitable for lamb production, with the Dorset Merino cross probably being the dominant type of lamb produced for slaughter there.

In New Zealand the discounts which apply to the majority of Merino ewes as a result of ribby pelts, a high incidence of seedy pelts and the likelihood that wool weight assessments on Merino cross lambs tends to be under estimated (because more regard is paid to staple length rather than density), have probably made farmers following a flying stock operation, somewhat cautious about buying in Merino ewes. Also, freezing companies have indicated that Merino wool yields poorly and is hard to dry although the wool commands a premium price. The slow growth rate of the

Merino must have some influence on the growth rate of the crossbred lamb and this may be another factor that needs to be taken into account.

I would like to revert to consideration of the Merino as a producer of lambs for slaughter. While not being familiar with high country farming conditions it would appear from recent evidence produced by the New Zealand Meat and Wool Boards' Economic Service that where costs are high in terms of application of fertiliser and transport, etc, and lambing percentages are low, nett profits are likely to be improved by reverting to a store stock policy and/or concentrating on wethers for wool production. If a high country property has an area of medium to good productive pasture of reasonable topography, it may be better to run it as a separate operation — stocked with the most appropriate breed of sheep for the conditions rather than trying to finish slow growing Merino lambs which are unlikely to reach good slaughter weights and which may well be penalised for ribby pelts.

In summarising, the Merino has in my assessment, only a limited role to play as a producer of pure or crossbred lambs for slaughter. However, the Merino has given us the scope for further improving reproductive capacity through the Boorola and the Merinos, basic characteristics of low subcutaneous fat cover and good eye muscle area are features which our geneticists should be considering how to capture and incorporate in our other dual purpose breeds. Clearly though, this is an extremely complex and difficult task and should only be one element of our strategy aimed at producing leaner lamb.

An industry review

R. H. M. Johnston*

Obviously, the review cannot focus specifically on the micron range of wool fibre which you as Merino and halfbred producers represent, but will cover the broad spectrum of New Zealand wool production, its challenges, its problems and accomplishments, and its place in the textile world.

One cannot discuss halfbred wools in that "middle micron" range without also including Corriedale wools which, from a marketing and processing point of view, are almost identical and have the same parental background.

As you are no doubt aware, the first sheep to arrive in New Zealand were a Merino ewe and ram — brought to Queen Charlotte Sound by Captain Cook in 1773. The animals died within four days, apparently from tutu poisoning. Samuel Marsden brought more Merinos to the Bay of Islands in 1814 but the first permanently established flock was set up near Wellington in 1834.

From there the industry grew rapidly and the Merino became firmly established. With the introduction of long wool breeds — Lincoln, Leicester and Romney — came the development of the halfbred. Later the Corriedale was introduced to stabilise the first cross.

Land development and pasture improvement saw the Romney take over as the predominant breed and New Zealand was to become better known in wool production terms as a producer of carpet wools.

Today, the Merino is confined mainly to the high country of the South Island. Two million Merinos produce about 5.6 million kilograms of 2.2 per cent of growers' greasy wool sold at auction — wool in the 19–24 micron grouping.

Halfbreds, on the other hand, whether Lincoln, Leicester or Romney Cross, are run principally on properties in the hill country of the South Island which have environmental and geographical aspects usually more favourable than those areas running Merinos in the higher or drier country.

It is estimated there are 2.4 million halfbreds which account for 60 million kilograms or 2.3 per cent of growers' greasy wool sold at auction — that wool is in the 25–31 micron range. If Corriedales are included they collectively account for 7.3 million sheep.

However, the figure representing the amount of grower's greasy wool sold at auction for Corriedale wool is a little more difficult to calculate as there is an overlap in the micron grouping — halfbred (25–31 micron) and Corriedale (28–33 micron). However, the amount of growers' greasy wool sold at auction in the 25–33 micron range is 87 million kilograms or about one-third of the total.

Through the years of change in the development of the New Zealand wool industry, one fact has remained constant. Wool was and is of substantial importance to the New Zealand economy and the living standards of each and every New Zealander. In fact for more than 100 years it was the country's biggest export earner. In the mid 1960s the companion product meat took over the number one position while wool today disputes second place with dairy produce.

Even from such a partisan position as mine, it does not do to view the sheep merely from the point of view of wool. Refrigeration changed all that, encouraging farmers to produce a dual purpose animal producing both meat and wool. The development of the frozen meat industry was probably primarily responsible for the de-

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velopment of the halfbred and later the Corriedale, which was truly a dual purpose breed. However, other dual purpose breeds tended to produce coarser wool.

Today, 85 per cent of our 70 million sheep are Romney or Romney crossbreds. New Zealand supplies about 70 per cent of the world's coarser crossbred wool entering international trade, and 40 per cent of the wool used in the world's carpet industry.

It is not an easy task to ascertain a full end use pattern of the New Zealand clip. Of our current production of about 380,000 tonnes, current figures indicate about 54 per cent goes into carpets, and other end uses in order of importance include hand-knitting yarns, blankets, furnishing fabrics, knitted outerwear and woven apparel.

New Zealand is the third largest of the world's wool producers, accounting for about 12 per cent of the world's 2.7 million tonnes annual production. Australia produces about 27 per cent and the Soviet Union is next with 18 per cent. Since almost all of the Soviet production is consumed domestically, New Zealand is, in export terms, the second largest supplier to the international trade.

Western Europe and the United Kingdom take about 40 per cent of our production. However in the past few years the world's wool textile industry has shifted noticeably toward Eastern Europe, the Far East, the Mediterranean and Asian countries such as Taiwan, Hong Kong and Korea.

In each of the past two seasons, the United Kingdom has been toppled from its traditional position as our most important customer, firstly by the Soviet Union, then last year by the Peoples' Republic of China. This season, Japan is heading the list.

The New Zealand wool textile industry has always been a significant customer for the New Zealand wool clip, usually taking about 150,000 bales or six per cent of total production. About half of this is destined

for export mainly in carpets and carpet yarn, the other half is for domestic consumption.

At 2.5 kilograms consumption per head of population per year, the New Zealander is the world's third largest wool consumer, following the Icelanders and the Swiss.

Almost all the Merino production and a significant section of the halfbred clip is purchased by local mills, producing woven apparel and hand knitting yarns. Yours is a vital segment of New Zealand's wool processing industry.

On the international front, wool's share of the world's total fibre market has declined from over 10 per cent to 5 per cent in the past 20 years. This is because the world's population is rising at a faster rate than world wool production and our continued presence cannot be taken for granted — we must fight for our share of processing machine capacity in the face of the continuing threat from the synthetic fibre industry.

Wool is fast becoming a scarce premium fibre, more expensive than synthetics — often twice the price at the mill door. However, in recent years there has been a strong fashion move to natural fibres and to quality — two factors which have confirmed wool's position at the top of the textile tree.

It must be remembered that the promotional and research weight of the synthetic fibre industry is immense — worldwide spending runs into billions of dollars. One company alone spent \$400 million in one financial year. Some of their new generation fibres are excellent and their promotional thrust is pitched at capitalising, for their benefit, on wool's characteristics.

Wool's promotion and research activities are therefore vital and the International Wool Secretariat and research laboratories in the sponsor countries are the major weapon for growers.

One of the fundamental objectives of the IWS is to increase the demand pressure for wool through promotion and research and,

thus, increase the demand and price for your raw wool. Other objectives include:

- To improve the performance of wool to meet the changing requirements of manufacturers and consumers.
- To reduce or contain processing costs within the wool textile industry, including energy costs and pollution problems.
- To develop new and attractive products in keeping with today's lifestyle.
- To solve the technical problems of wool users.

From modest beginnings in 1937 the IWS now operates in 50 countries with five major area sections and a headquarters in London.

A large global budget for promotion and research is augmented by a substantial commitment from manufacturers, wholesalers and retailers adding 112 cents from the industry for every \$1 spent on promotion by the IWS.

Funded by four Southern Hemisphere grower countries, the main thrust of the effort is in the large consumer markets of the Northern Hemisphere, which is spear-headed by the Woolmark, our internationally acclaimed symbol denoting pure new wool and a quality product.

Running against a global trend of static or, in some cases, declining production, New Zealand wool production has increased dramatically over the last four seasons, in fact some 24 per cent from 311 million kilograms in 1977–78 to 381 million kilograms last season, with this current season likely to be back marginally. This has brought with it attendant problems and challenges.

Over this period, the Wool Board has re-examined all facets of its total involvement in the industry to ensure it is properly positioned to meet the requirements of the 1980s. It has done this in a number of ways:

- More selling opportunities are now available and sale by separation has been firmly established.

- Objective measurement and Sale by Sample now account for 60 per cent of the auction offering – a dramatic increase in the past five years.
- New laboratories for testing have been established in Christchurch.
- New high density presses for both greasy and scoured wools have been installed and concessional freight rates negotiated for higher densities.
- Shearing training continues and blade training expands.
- Wool classer registration is increasing as the need for proper preparation of our clips becomes more widely recognised.
- Wool Handling Certificates introduced to encourage a higher level of performance in the shearing shed.
- The Board's own storage facilities expanded to give it the capacity to store larger quantities of wool if market conditions deteriorate.
- Research work at WRONZ, focusing principally on scientific and technical developments in the crossbred field. It should be noted that fine wool research is undertaken by the C.S.I.R.O. laboratories in Australia, but global research is co-ordinated to avoid unnecessary overlaps.
- The expansion of the Board's external Market Development Division, working in a complimentary manner alongside IWS to seek new market opportunities. In this regard, one of the most exciting developments and important in terms of the future has been the emergence of the Peoples' Republic of China as a major buyer. This market offers tremendous scope for further increases in domestic consumption of wool in a country approaching 1,000 million people.
- A continuing presence in the market place and the operation of our floor price and intervention levels to give stability to the market and underpin prices during periods of depressed market activity.

These are just some of the things the Board has done to respond to the challenges we face today.

In both the last season and the current season the Board has been very active in the market, operating principally on cross-bred wools.

In fact the only categories which have not needed Board support have been Merino, halfbred and Corriedale wools.

For the first time in almost a decade, prices for your wool have reached something approaching realistic levels and international market conditions have returned to a more historical relativity.

However the economic health of our major consuming countries has not, by and large, been good and the market has been somewhat depressed for the bulk of the clip.

The Board entered this season with 345,000 bales in stock and as a result of a temporary fillip in prices was able to feed back into the system around 50,000 bales. By December 1981, stocks had been reduced to 295,000 bales but climbed rapidly as the main weight of wool came on the market over December, January, February. To date, stocks stand at 430,000 bales, costing some \$150 million.

The Board has bid (on average this season), on 30 per cent of the offering and purchased 11 per cent this season. At times the Board has bid on 80 per cent, buying 40 per cent and at others bid on four per cent and bought one per cent.

The average AWASP so far this season is around 261 cents per kilogram greasy compared with 249 cents last season. Some \$12.5 million of growers funds have been paid out by way of supplementation — the difference between the actual market and the Board's Average Floor Price Level of 250 cents per kilogram greasy.

While all wool has attracted Government SMP up to 320 cents average no combing wools [26 micron or finer] have attracted Wool Board supplementation or intervention support. In pursuing this policy of market support, the Board keeps

clearly in front of it the principle objective for which it was established and to quote from the Act. "To obtain, in the interests of growers the best long term returns for wool."

The Wool Board has not been without its critics this past few months which I acknowledge.

There is, however, a delicate balance which must be struck between being too aggressive in the marketplace and becoming financially over-exposed and denying our customers their fibre, and on becoming too soft which would weaken the overall tone of the market and do nothing to protect the value of wool both in the pipe line and that coming forward for sale.

Our intervention levels are flexible, and under continuous review and every endeavour is made to pitch them at levels which we see as being sustainable for as far ahead as is perceivable.

To our critics I would say this — I acknowledge we cannot control the market but what we can do is influence it, and to that end I believe by and large we are being fairly successful. Notwithstanding the size of our stocks to date, it is important to keep things in perspective. We have sold at auction this year up to March 31 more wool than up to the corresponding period last season — 1.294 million bales against 1.216 million.

Another way of looking at it is to say that broadly we have taken into stocks the volume of wool equivalent to our increase in production.

We are facing marketing difficulties for the major segment of our clip — fortunately your segment is enjoying better times.

Notwithstanding the promotional and research effort which is undertaken for our fibre, we are still looking ahead to a major recovery in the economic health of our major consuming markets — when there is a significant increase in discretionary spending power by the consumers in Northern Hemisphere countries.

Wool has to keep up the pressure to maintain its position on that top branch of

the textile tree and that means leadership — leadership in fashion, leadership in research, leadership in marketing and promotion.

I do not ever foresee the day when wool is going to be totally swamped by synthetics — there will always be a market for a premium fibre, just as there will always be a market for a Rolls Royce or a Lamborghini — but it is going to require constant

leadership and innovation for wool to maintain its market profile.

This leadership must come from all levels: from grower representatives, from Government, from the manufacturing sector, research establishments, promotional organisations and seminars such as this, which confirm my feeling that we are already many steps ahead.

