PRESIDENTIAL ADDRESS

New Zealand crossbred wool: aspects of its production uses and prospects

G. A. WICKHAM

One hundred years ago, at Port Chalmers, a sailing ship was being loaded with frozen carcasses. That shipment to England is of great historical importance to New Zealand animal production and it is appropriate that this conference should note the occasion.

While the impact of that event on meat production is well appreciated, its consequences for wool production in New Zealand are often not recognised. It is the intention of this address to give a brief historical account of the changes in the New Zealand wool clip following the development of the export lamb industry and how these affected the uses of the wool by the textile industry. An appreciation of these events is helpful in understanding many present-day opinions and procedures of wool producers and handlers.

The Effect of the Frozen Meat Trade on Sheep Breeds

In early New Zealand pastoral farming the Merino breed of sheep was dominant as a result of the high prices paid for its fine wool, its good fleece weights and its ready availability from Australia. Mutton was a minor by-product of the wool-producing industry. In these circumstances the low fertility, slow growth rate, lack of conformation to desired carcass shape and susceptibility to footrot of the Merino were generally outweighed by the breed's productive advantages.

The 1880s and 1890s saw a rapid growth in frozen meat exports. This was a period of low wool prices with fine wools particularly depressed. During the 1880s the price of Merino and halfbred wool was 11 to 22 c/kg while the price of lamb meat rose to 4.5 c/kg (Stevens, 1961). This provided an economic reason for many sheep breeders to mate their Merino ewes to British Longwool rams and the proportion of "halfbreds" in the sheep population grew rapidly. The wool produced by the Merino-cross sheep was initially called "crossbred".

While many breeders, particularly in the South Island, stuck with half-Merino sheep the majority continued to dilute the Merino genes by using British Longwool rams (Carter and Cox, 1982). Initially Lincoln rams were mainly used but for the last 60 to 70 years (about 20 sheep generations) the Romney has predominated. Despite the fact that a high proportion of flocks have used purebred Romney rams exclusively in that period and only about 1/100 000 part of their genotype is non-Romney the fleeces are still termed crossbred. The New Zealand wool trade has adopted a convention of referring to clips from half-Merino sheep as "halfbred" even though in Australia these wools are still termed "crossbred".

Changes in New Zealand Wool and Its End Uses—1882-1982

No satisfactory statistics were kept of the type of wool produced in New Zealand until well into the 20th century and the first satisfactory study of the end uses of New Zealand wool was only carried out in 1967. Nevertheless, knowledge of the distribution of breeds (which was also poorly recorded) and the type of wool produced by these breeds allow assessments of the changes in the type of wool produced. Relating the type of wool to the products of the British textile industry, which took almost all the early New Zealand wool clip, allows some educated guesses and Carnaby (1981) provided one set of estimates of the changing end uses of New Zealand's wool clip.

Clearly the dilution of the Merino genes in the New Zealand sheep population led to the clip becoming steadily coarser over the years from 1880 to 1910. Merino wool was probably largely used for the manufacture of fine worsted fabrics for male and female apparel of the middle and upper classes of the British population. The shorter types of Merino wool were probably mainly used in the knitting or hosiery section of the textile industry with socks and woollen underwear major end products. In the mid 1880s the lower classes in Britain probably only used coarser wool fabrics made from locally grown wool which was much cheaper. However the rapid expansion of Merino wool growing in the colonies led to an erosion of the price premiums for the Merino wools by the 1880s and for several years the prices of Merino and halfbred wools were similar in New Zealand. The coarser wools produced by the Merino-cross sheep probably found uses in thicker worsted

fabrics and knitwear with socks a substantial part of this knitwear.

As the longwool sheep began to become more important there was a major change in the type of wool produced. The Lincoln, which was the major longwool sheep at the turn of the century, produced fleeces of about 40 microns diameter as compared with the 20 microns of the Merino. Much Lincoln wool was used for flags and buntings and it had other non-apparel uses. It found its main apparel use in cheap, hardwearing but scratchy serge fabrics, used largely by working class men and also in military uniforms of the lower ranks.

By the 1920s a considerable sector of the British textile industry had developed a dependency on New Zealand supplies of this long, coarse, lustrous Lincoln-type wool. However the New Zealand sheep breeders became disenchanted with the Lincoln and began to grade up their flocks to Romney. While the shift in wool type was not as drastic as that resulting from the Merino to Lincoln change it brought some highly publicised complaints from the serge-producing sector of the British wool industry. Beliefs engendered by these complaints have influenced New Zealand sheep selection procedures to this day. Since fibres in worsted yarns produced from Romney wools did not tend to lie as flat as those from Lincoln wools the yarns were described as being hairy and this was blamed on the presence of unevenness of diameter and medullation of fibres. More recent research results would suggest that shorter fibres and higher fibre crimp in the Romney wool are far more likely explanations. However this publicity led to fleece hairiness dominating wool research and sheep selection in New Zealand for many years. The fact that greater demand for Romney-type wools from other sectors of the textile industry led to these fetching a higher price than Lincoln-Leicester type wools (Sidey, 1931) received little publicity.

Worsted fabric manufacture became progressively less important following changes in life style and fashion. The strait-jacket-like properties of heavy garments woven from stiff worsted yarns did not suit a population seeking less formality and greater comfort. Also the processing systems to manufacture these coarse worsted yarns were not modernised to keep pace with other developments in the textile industry. Woollen fabric manufacture and hosiery, together with blankets, became the important end uses for some time but gradually the use of these also fell away. As people became more affluent and as the petroleum and chemical industries became more powerful from 1950 onward the greater use of heated homes and transport further reduced the need for heavy clothing while the synthetic fibre industry provided raw materials for forms of clothing that seemed to suit the new life style.

Fortunately the change in life style created a marked increase in the demand for wall-to-wall carpeting and this provided an alternative end use for the New Zealand crossbred wool which was no longer being used in clothing. The growing importance of tufting as the preferred method of carpet manufacture and the need for strong yarns for this process led to New Zealand crossbred becoming the main component of wool carpets. By 1967 37% of all New Zealand wool was used in carpets (IWS 1970) and a less reliable estimate (McNeill 1981) suggested that in 1979/80 50% of all New Zealand wool and most of the coarse crossbred was used in carpets. Probably the percentage was even higher in the mid 1970s for there are recent signs of an increasing use of the finer types of New Zealand crossbred wools in knitwear. One indication of this is that, over the last 2 years, China has been buying a large quantity of New Zealand crossbred wool finer than 34 microns for the manufacture of hand knitting yarns.

Aspects of Crossbred Wool Quality

One of the most difficult exercises with crossbred wool is to try and define what is best or even what is good and what is bad. A characteristic desirable for one processing system and product is often completely undesirable for another processing system or product. This is true for long length, fineness, medullation, high crimp, whiteness and many other traits. Wool quality must be defined in terms of end use yet many traditional woolmen are prepared to categorically state that one type of wool is good and another type of wool is bad.

Perhaps the major factor allowing older woolmen to hold such faith in their beliefs is that wool processing and evaluation were tradition-based crafts. Fifty years ago most people learnt the wool trade while serving apprenticeships. Many of the more influential New Zealand woolmen gained their introduction to wool with British worsted manufacturers where they became very strong believers that the best wools were those most suitable for worsted processing.

In the last 30 to 40 years research into wool attributes and processing systems together with the development of more effective education has provided the basis for the wool industry to become a true technology. However, initially most of the research was on Merino wools and worsted end uses and it is only in the last 15 years that a significant amount of work on crossbred wool and its end uses has been done.

Commercial Wool Evaluation

One result of the pattern of evolution of the wool clip and the industry's tendency to retain traditional methods was that, until the mid 1970s, New Zealand used a wool evaluation system designed largely for

purchasing wool for use in the worsted system. Recent changes to the system have largely followed the Australian lead in the adoption of pre-sale yield and fibre diameter testing and the adoption of sale by sample. There is now a great need to clarify the way various crossbred wool traits are related to performance in modern processing systems and how important traits can be evaluated efficiently prior to sale. Some progress has been made in identifying the traits which influence carpet performance but there is still much to do in this area (Story, 1978).

Factors Influencing Crossbred Wool Prices

The premiums that manufacturers will pay for wool having above average levels of various characteristics are one set of indicators of the factors determining wool quality. However the manufacturers' knowledge of the influence of traits on present uses of crossbred wool is rather sketchy. Most find a blend that produces a reasonable end product efficiently and then do little experimentation with blend modifications to see if efficiency can be improved. They will continue with their standard blend unless there are good indications of a substantial financial incentive if they modify it. If research institutions produce results indicating advantages of different types of wool then manufacturers tend to incorporate more of these in their blends if this is financially advantageous. Thus the prices paid are imperfect reflections of wool quality but nevertheless they are useful indicators.

Information on price relationships can be gained from newspaper reports and the annual statistics of wool sales (e.g., NZWB, 1981) but these only allow estimates of the effects of a limited number of traits. Recently the New Zealand Wool Board commenced keeping more detailed records of wool sales in a central computer and these have allowed more intensive analysis of prices paid at auction (Wiggins and Beggs, 1980; McPherson, 1982). These analyses point to length being the main determinant of clean wool price of medium to coarse crossbred wool. Apparently growth in second shearing has led to an oversupply of wools shorter than 100 mm. This must be contrasted to the situation with Merino wools where mean fibre diameter is of overwhelming importance.

In the 1980/1 season Wool Board appraisers collected data on traits not previously assessed and analyses of the effects of these traits on prices paid for crossbred wool has provided some interesting results (McPherson, 1982).

Style, as denoted by letters such as BB/B, or BC or descriptions such as Good/Super, is a composite trait graded according to level of faults such as colour, unevenness, medullation, etc. The 1980/1 data indicate that almost all the variation in price due to style is explained by the colour of the wool. While other aspects of style, such as character, were not recorded, they could not have explained much additional price variation.

Lines that were considered especially uneven in fineness or length were noted in these data. Brokers and others commonly suggest that such unevenness has adversely affected prices at sales yet processing trials indicate that such unevenness does not have much effect on the performance of the wool. In the 1980/1 data there was no price difference between those lines noted as being uneven, and similar wool not so noted.

Future analyses of this type will allow a greater understanding of the factors determining wool prices. It is desirable that the Wool Board record the levels of traits which are believed to be important in the more recent end uses of crossbred wools (bulk is an example), for which practical techniques of measurement have recently been developed (e.g., colour measurements and fibre diameter variation) or which sheep breeders tend to consider (e.g., character and hairiness).

Information From Processing Trials

The most reliable information on the value of fleece characteristics comes from trials where the level of a raw wool trait can be related to processing efficiency and the value of the product produced. Unfortunately there have been insufficient trials of this sort with crossbred wools to supply a comprehensive pool of knowledge. Nevertheless, in recent years, much has been learnt about the value of different types of crossbred wool in carpet manufacture. There is a little similar information for other common end uses.

Apparel end use research, mainly on Merino wools, indicates that mean fibre diameter is of great importance since it is an important factor in determining the fineness of the yarns that can be spun and the softness and flexibility of the garments which can be manufactured (Hunter, 1980). In contrast the fibre diameter of the wool used for carpets has some influence on the type of carpet produced but little real effect on the processing efficiency or the performance of the carpet (Ross *et al.*, 1980). The processing trials conducted so far suggest that bulk is probably the most important wool characteristic determining the performance of the carpet.

Fleece Traits Considered in Selection

Many breeders of sheep producing crossbred wool have not adapted their culling procedures to the present end uses of the wool and continue to emphasise wool traits that have not been appropriate in the last 20 years. For example the traditional Romney breeder continues to select for evenness of quality number, a well defined staple crimp and for

lower fleece hairiness. These were worthwhile objectives when the end use was serges and similar products of the old Bradford worsted system but they are of little relevance to the present end uses. The breeders' traditional thinking is reinforced by judges in fleece competitions in agricultural shows since the judging cards for these competitions place considerable emphasis on these same traits.

On the basis of present information on prices and genetic parameters for wool traits, selection for whiter wool will probably earn greater returns than selection for any other wool quality trait in Romney type sheep. However with present prices it is difficult to justify selection of these sheep for any wool quality trait. The premiums paid are so small that any extra returns from improved quality are insignificant relative to the returns that can accrue from selection for improved fertility and fleece weight. This situation could easily change as a result of changes in end use or processors learning that a trait had a greater effect than had previously been suspected.

The Future of Crossbred Wool

Many of the past changes in the nature of the New Zealand wool clip have followed changes in breed composition aimed at improving the efficiency of sheep-meat production. Reproductive efficiency of the ewe is the main factor determining the efficiency of sheep meat production and future changes in breed composition will probably depend on the relative lambing percentage of the various breeds. The Finnish Landrace could well have a major effect, if a way of overcoming the exotic disease risks can be devised, but at present the Booroola looks the most likely modifier of the wool clip. If a good proportion of the New Zealand flocks attempt to lift lambing percentage by incorporation of the Booroola fecundity gene the clip will contain a higher proportion of finer wool more suitable for hosiery than for carpets. It may of course be possible to introduce the fecundity gene after dilution of the fine-wool genes in the Booroola.

It is extremely difficult to predict the demand for crossbred wools for different products since future end uses will depend on technical developments in wool and synthetic fibre processing as well as fashion. Increasingly wool is becoming regarded as a prestige fibre with wool products capable of selling at a higher price than similar products in other fibres. However this can change very quickly, as witnessed by the swing from wool and other fibres to cotton for men's trousers despite the apparent technical advantages of wool in this end use. Of the two present major end uses, carpets and knitwear, wool looks to have more advantages over synthetics in knitwear and it may well be that this market will expand more in the near future but technical factors tend to have less influence than fashion. Factors of recent importance in the use of New Zealand wool are planning decisions in the centrally directed economies of Russia and China and these decisions seem harder to predict than fashions in Western clothes.

The New Zealand sheep farmer is placed in a very vulnerable position by the limited use of crossbred wool in non-carpet end uses. To alleviate this lack of flexibility it is highly desirable that the use of crossbred wool in other products should be developed. Such developments are more likely to be successful if they arise from the joint efforts of animal and textile technologists. These two professional groups should also work together in developing a greater understanding of how animal and textile technology can combine in producing wool products more efficiently. Perhaps the greatest immediate need is for the textile technologists to define the relative importance of wool traits in the end products of crossbred wools so that animal scientists can define their objectives in improving the quality of wool.

Greater knowledge of the traits defining quality in crossbred wool would also be of value in defining future wool selling systems. Present indications are that in the near future buyers will purchase most wool on the basis of specifications provided by testing authorities and will not view samples. These specifications will include traits not previously considered.

REFERENCES

Carnaby, G. A., 1981. *A study of some historical factors which have affected the end uses for New Zealand wools 1880/1980.* Wool Research Organisation of New Zealand, Technical Paper.

Carter, A. H.; Cox, E. H., 1982. In *Sheep Production Vol. I Sheep Breeding and Reproduction* (Eds G. A. Wickham and M. F. McDonald), N.Z. Institute of Agricultural Science, Wellington. p. 11.

Hunter, L., 1980. *Proc. 6th Int. Wool Text. Res. Conf., Pretoria, 1:* 134.

IWS, 1970. *Market investigation: end uses of crossbred wool.* International Wool Secretariat, London.

McNeill, I., 1981. *End uses of New Zealand wool.* N.Z. Wool Board Internal Report.

McPherson, A. W., 1982. M. Agr. Sc. thesis, Massey University.

NZWB, 1981. *Statistical analysis of New Zealand wool sales 1980/1.* New Zealand Wool Board, Wellington.

Ross, D. A.; Dorgan, J. J.; McFarlane, I. D.; Elliott, K. H., 1980. *Proc. 6th Int. Wool Text. Res. Conf., Pretoria, 4:* 293.

Sidey, D. J., 1931. *Defects of New Zealand Wools.* Bulletin 30, Department of Scientific and Industrial Research, Wellington.

Stevens, P. G., 1961. *Sheep Part 2, Sheepfarming*

developments and sheep breeds in New Zealand. Whitcombe and Tombs, Wellington, 184 pp.

Story, L. F., 1978. *Carpet wools: carpet manufacture.* Wool Research Organisation of New Zealand, Christchurch.

Wiggins, L. K.; Beggs, D. M., 1980. *Wool 7* (1): 39.