DEFECTS OF NEW ZEALAND WOOLS

D.J. SIDEY

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The following statements give a fairly full account of the various defects found inNew Zealand wools. It is somewhat difficult to assess the economic importance of each defect since it has to be remembered that the first essential of wool is that it shall act as a protective covering for the sheep, and that other factors, for example, the demand for early maturity and shape of carcase, in the case of the fat lamb, are of more importance than is the wool produced by the lamb. As already has been pointed out, a wool that through some peculiarity or defect may be unsuitable for one trade may be quite suitable for some other trade, and, in consequence, is not very much penalised in price by reason of its defect. There is, therefore, not much incentive to the producer to eliminate the defect, in fact, in some cases in the past it has paid him to ignore the criticisms and aim at producing maximum weight instead of maintaining a balance between quantity and quality.

1. Presence of Irregular Fibres:

This is probably the most outstanding defect in New Zealand woold, of which complaint is made, and the irregularity may take a number of different forms:-

(a) Fibres of widely different size in the same staple, in most cases the larger fibres being medullated for part, if not all, of their length, while the finer ones are true wool.

(b) Fibres varying in diameter along their length, in many cases due to medullation at the tip, which results in thickening of the latter,while in other cases it may be due to a period of semi-starvation, especially during the late winter and early spring periods.

(c) Fibres considerably varying in length in the same staple, which, while to a greater or lesser extent present in all wools, often is a decided characteristic of wools resulting from crossing of two breeds of sheep.

(d) Fibres, although of fine wool, varying in size and shape, but not to the extent of those outlined in (a).

(e) Presence of kemps in the wool.

The factor of varying fibre diameter, especially when due to medullated fibres, has been the cause of the outcry against New Zealand wools by Bradford wool-buyers; and in the case of some of our cross-bred wools, especially those from part of the Wanganui, Taranaki, Hawke's Bay, and Auckland districts, there appears to be ground for the complaint. The eradication of this defect presents a serious problem. The Major difficulty in this connection is to know the exact cause or causes of the appearance ofthese medullated fibres, and why they should be in evidence to a greater extent in one year than they are in the next. Undoubtedly, one of the predisposing causes is a genetic factor or factors, apparently not confined to any single breed. However, nutritional and climatic conditions appear to play their part. That this is so is shown by the remarks of one Bradford buyer of large quantities of New Zealand cross-bred wool, who in conversation with the writer on this particular point, stated that even in some of the best Southland Romney clips a variation in the amount of medulla and thickened tip occurred from year to year. In one year a clip might be moderately free from it; the next year fairly bad, and the following year fairly free again, showing that factors other than those of genetics at work; but it is difficult to determine how much of this difference is due and how much may be due to some other cause.

In private correspondence with the writer, J.F.Wilson, of California, who has carried out considerable work on medullated fibres in the Romney and other breeds states that after several years of work on the subject he still

is in the dark regarding all the causes of medullation. He states that in one case at least that he has observed, only a change of nutritional and climatic conditions could acccount for a greatly increased percentage of medullated fibres in one flock. He states, further, that in actual feeding experiments he has not been able to reproduce similar effects. He suggests that the reason why it usually is the coarser fibres that are medullated probably is that in the stronger wodled breeds the tendency to produce a hairy outer coat has not been so completely bred out as it has been in the finer-wodled breeds. This fact, combined with a certain set of nutritional, climatic, and breeding conditions, may bring out a characteristic which under more favourable conditions is masked. 'It may be that a contributing cause of somuch medullated fibre in some of the cross-bred wools from certain districts in New Zealand is the extensive use of cross-breeding, which has been practised in the past, bringing out latent characters.

Barrit and King[2] have shown that medullated fibres are low in sulphur and my own and other work has shown that, as a rule, Romney wool is low in sulphur content as compared with other wools. It is possible, therefore, that there is some direct connection between these two factors, combined with a low percentage of organic sulphur in the pasturage on which the sheep have to live, that is a predisposing cause to the production of medulla. If there is a natural short supply of protein sulphur in the blood stream, then it is likely that the larger-sized and quicker-growing fibres will be the first to suffer from this deficiency, and so produce medulla, which theory is in accordance with Wilson's work. It here may be pointed out that Aitken,[7(3)] in New Zealand and Woodman and a co-worker, at Cambridge, have been unable to isolate cystine (the sulphur-rich amino-acid found in wool) from ordinary pasture grass, but both have found about equal proportions of inorganic and organic sulphur. The Cambridge workers, however, have found about twice the total amount of sulphur that Aitken has found in New Zealand grass. How much this is due to the stage at which the grass was cut for analysis, and how much of it is due to the real differences in the sulphur nutrition of the New Zealand grass, or to differences in the technique of estimation, it is difficult to say. It may be, however, that this low sulphur percentage in New Zealand grasses is one of the contributing causes of our medullated wool; and it is a point worthy of further investigation when funds are available. If it is found that in certain localities the grass is naturally low in sulphur, then manuring with ammonium sulphate may improve the position, as Mr. Godden, of the Rowell Research Institute, pointed out that in his experiments this manure had increased the percentage of total sulphur in the herbage, but he could not say whether the increase was in the organic or inorganic sulphur compounds.

Some form of thyroid activity also may be a contributing factor, as is shown in the experiments carried out at the Animal Breeding Research Station, Edinburgh.[4] When Scotch Blackface sheep have been thyroidectimized their coarse, medullated fibres lose most if not all of their medulla, and appear to take on some of the characteristics of normal wool.

The most hopeful means of improving this class of wool seem to be in the direction of improving the nutritional conditions of the sheep, especially in the direction of evening-up the food supply during the different seasons and at the same time selecting within the flocks already existing in these districts, sheep - both rams and ewes - with the desired type of wool. The necessity of selectingwithin the already existing flocks is because the sheep have become acclimatized to the conditions, and a certain amount of natural selection will have taken place. The necessity for this procedure is pointed out by Hammond[4]. However, the whole question of nutritional effects on the production of medullated and irregular wool probably is one of the most important facing some of the producers of cross-bred wool at the present time. The area from which comes the bulk of the wool of which complaint is made includes much of the land that comes under the Deteriorated Land Board. It is a well-known fact that no matter how wellbred any class of animal may be, given poor nutritional conditions it soon will deteriorate. Therefore, if nutrition does play a part in the production of this bad wool (and there appears to be every ground for assuming that it does play some part), it may be futile to attempt to improve the wool produced on this class of country by the introduction of good-woolled sheep, since these would deteriorate during the course of a generation or so.

Where, however, indifferent wool is being produced under what should be normal conditions of nutrition, then selection of suitable breeding stock with

desirable wool is the first essential. However, much improvement need not be expected for a number of generations, since the genetic factors for producing this indifferent wool must be involved and well-distributed throughout the flocks. Although it may not show itself externally, in the form of bad wool, it quite likely may be present in the germ plasm, and require only a suitable mating to bring it out. For the work to be effectively carried out it will be necessary to select both rams and ewes with wool as near the ideal as possible, breed these together, and then inbreed the progeny, always selecting those with desirable wool and culling undesirables. The work, however, will be slow, since there are many difficulties in the way, such as a sheep producinga desirable fleece one year and a bad one next. Speeding-up may be effected, however, by using stock from a flock that is as near as possible to being free from the trouble.

The second defect mentioned, i.e., variation in diameter along the length of the wool fibres, is another that the Bradford manufacturers have strongly stressed. The presence of a medullated or thickened tip would appear to be largely bound up with the question of genetics and climatic and nutritional conditions soon after shearing; and from the producer's point of view, they would be very difficult to control. In some quarters it is thought that the trouble is an hereditary one, but it is questionable whether it can be wholly accounted for in this way, as the trouble considerably varies from year to year, and is not confined to any particular breed. From the manufacturer's point of view the trouble is important for three reasons, the first being that it results in a larger percentage of noil to top, this being wasteful. The second is that all of the thickened tip is not removed in the combing process, and when the subsequent yarn is manufactured into cloth, these ends of thickened fibre stand out from the cloth and give to it a roughened surface. The third reason is thatany medullated fibres mixed with ordinary wool dye a different shade so that uneven colouring usually results, which in some cases is undesirable, but which in others may be useful.

The eradication of this defect will not be a simple matter, because as has been pointed out above, it is not confined to any one breed, and climatic and nutritional conditions, over which the farmer can have little control, probably are the chief causative agents. However, a certain amount of selection along the lines of cullingsheep that continually produce too much thickened tip should be helpful, although any culling based on a single year's fleece may mean the elimination of what might be a quite useful sheep.

The problem of longand short fibres in the same staple to some extent is bound up with the defect of coarse and fine fibres occurring together, since, as a rule, the coarse fibres are much longer than the fine ones. From the manufacturer's point of view it means that when the defect is present to any marked extent there is an uneven behaviour of the fibres during the drawing and spinning processes which results in the final yarn not being as level and as smooth as it should be. Here, again, is a problem that will not be very easily solved; but an attempt to improve matters can be made by carefully examining the wool ofselected sheep by drawing out the fibres in a sample of wool over a black background. By this means samples of wool showing excessive variations in length and in fibre diameter soon will be evident. There is a little doubt that this type of fibre irregularity is due in part to indiscriminate cross-breeding, which could be remedied by selecing a type and keeping to it.

The presence of irregular-sized and shaped fibres in the same lock, even when they are not medullated, is another defect, but one not so important as that of the presence of medulla. In the presence of these irregularities it is not possible to produce an even, flat-finishing yarn so desirable for the production of most high-grade materials, especially for the single-yarn and lustre goods trade. With two-fold yarns, however, the irregularities to some extent are covered up, and in the case ofsome yarns, especially for the hosiery trade, are not very important. When these uneven fibres are spun and processed, uneven strains are set up which are undesirable, especially if wool is to compete with artificially-produced fibres. It is necessary, therefore, to endeavour to breed out these irregularities to as great an extent as is possible so that manipulation of the fibres may be made easier, and so that more economic production may be assisted.

It has been shown by Barker and Burgess[1] that fibre irregularity probably is one of the contributing factors in the production of harsh-handling

wool. The writer already has pointed out (appendix 3) that in some cases where, in the trade report on the New Zealand wools, a particularly soft handle was noted, is was subsequently found that the wools were moderately round and even in fibre diameter. It would seem, therefore that by paying more attention to breeding wool with a soft handle, especially when accompanied by a certain amount of lustre, an avener and rounder-fibred wool will result. There is no doubt that a number of our best Romney stud breeders already are producing wool that is fairly free from medullated fibres, and meets the manufacturer's requirements. In many instances, however, this class of wool could be further improved if the aid of the scientist could be enlisted to assist the producer in selecting moderately even and round-fibred wools.

This factor of fibre irregularity without medullation probably is one of the most outstanding defects of New Zealand Corriedale wools, which, as a rule, fairly satisfactorily meet the requirements of the manufacturer. Improvement in this respect, however, should mean new and better uses for this class of wool, and improved fabrics which would be more readily able to compete with synthetic fibres.

A few years ago there was considerable discussion concerning the amount of kemp in New Zealandwools, especially in that from some of the Romney flocks, but while in England I seldom if ever heard a manufacturer use the word. Very few wools, especially those of the cross-bred types, are entirely free from kemp of some sort, although the percentage may be very small. The question of kemps very well illustrates how a wool, useless for one trade, may be quite satisfactory for another. An otherwise good wool containing a moderate amount of kemp may be useless for the manufacture of good serges and similar goods, and yet be quite satisfactory for a harris or other rough tweed where their uneven dyeing helps to lend variety and with the increase in plus-flour suits there has been a demand for this class of material. So far as New Zealand is concerned the problem does not appear to be serious, although in any flock where kemps occur, immediate steps should be taken, by selective breeding, to breed out the defect. Careful work by Show-yard judges and by the stud sheep inspectors appointed by the Breed Societies, in disqualifying any sheep showing even a moderate amount of kemp in the wool, should be help-ful.

11. Harsh-handling Wool.

This question has been partly dealt with above; but there are other contributing causes besides fibre irregularity, namely, size and shape of undulations or scales on the wool, dryness due to insufficient wool grease, faulty dipping of the sheep, and ,in all probability, the plasticity and elasticity of the fibres. These factors, with the exception of dipping, probably are partly genetic and partly nutritional in character, and to a certain extent can be eliminated by selection for soft-handling wool and more regular feeding of the sheep.

It here should be pointed out that Speakman, of the Textile Department of the Leeds University, has worked out a method of testing the scaliness of wool fibres by measuring the resistance to sliding when the fibres are stretched out like a violin bow. To use this method for selection work with sheep, however, would be a very long and laborious task.

The whole question of the amount of yolk or wool grease present in the wool is a very involved one. The wool buyer invariably penalizes wool heavy in grease, yet in so doing he probably is working against his own ends. Knowing that wool heavy in grease is penalized by the buyer, the breeder naturally is inclined to select away from this condition. However, Winson(5) has shown that, as a rule, wools heavy in grease are better spinning wools than are those lighter in grease but of the same spinning count, the reason being that the latter are not so regular and round in the fibre as are the former. This probably is due at least in part to the fact that the presence of the grease keeps the skin soft, and prevents irregularities in the wool as it is pushed up through the openings of the wool follicles. The wool grease also plays a part in lubricating the wool fibres, and in doing so preventing the lifting by friction of the surface scales, the tendency being to produce a softer-handling wool.

Faulty dipping also may cause what may be an otherwise soft wool to become harsh to the feel, especially towards the tip end; but this can be remedied by more careful attention to the whole procedure of sheep dipping.

111. Coloured Fibres in New Zealand Wool.

This is another fault of New Zealand wools ofwhich complaint is made, especially in the slipe wools from the Freezing Works. In this case, as a rule, the coloured fibres are brown or black, owing to the influence of the South Down and Shropshire sires of the fat lambs, and the trouble, naturally, is on the increase, owing to the more extensive use of the South Down. We have here a case where a Showyard requirement - in this case brown-coloured face and legs - may be in the best interests of the breed when production is considered. In order to overcome this defect the manufacturers have suggested the use ofthe Corriedale, Dorset Horn, and Ryeland rams in place ofthe South Down, as they have no brown hairs in their wool. This is a case where mutton and wool interests are in conflict; and it is a question whether it is an economic proposition to lose the early maturity and prepotency for carcase shape of the South Down in order to produce wool free from brown fibres. The Corriedale, good sheep as it is for certain localities, can have little claim for use as a fat lamb producer in place of the South Down, because, bred as it is at present, it is no betterthan a dual purpose breed, and in the production of ideal fat lambs it is necessary to use a purely mutton type of ram on the predoming ting dual purpose ewes. The Dorset Horn has been tried as a fat lamb producer in New Zealand and in other countries, but has no claim to superiority over the South Down. The Ryeland certainly is the most hopeful of the three breeds mentioned; and it becomes a question whether a little higher price for the wool will compensate for slightly slower maturity and not quite so good a carcase. While in England I made careful enquiries concerning the Ryeland, and the general opinion there was as it is in New Zealand, i.e., that the South Down was superior as a crossing sheep for fat lamb production: as it conferred earlier maturity and a more desirable mutton carcase.

As with mostother wool improvements, it is doubtful whether the wool-buyer will pay a premium for wool without brown fibres that will compensate the producer for losses in other directions. As has been previously pointed out it is not always the fault of the wool-buyers that they cannot pay this premium as the wool may bequite useful for certain sections of the coloured goods trade, while it is useless for whites or creams. The most obvious way in which to combat the trouble without the fat lamb producer being the loser, would be to select and breed South Downs with little or no face and leg colouring, and in so doing breed a strain of South Downs with no coloured fibres. Of course, the Breed Society probably would object, although there is no reason why a white-nosed and legged South Down should not be as good as a brown-coloured one, with the possible exception that straining to produce the ideal colour means more careful breeding methods. Since the coloured fibres in a Down cross fleece usually are concentrated near the extremities, i.e. legs and head, the Freezing Works and fellmongeries probably could improve the grading of their slipe wools if they were to take care when "pulling" the wool to place wool from these regions in separate lots.

The manufacturers also make complaint of coloured fibres which they describe as grey, often occurring in bunches in some of the Hawke's Bay clips of Romney-cross wool. The writer was unable to obtain a sample of this defect, and is at a loss to explain the occurrence of these fibres; but the defect probably is due to an admixture of black and white fibres. As a rule Romneys are particularly free from coloured patches in the wool or black lambs in the flock, although the writer has observed a Romney ram lamb that had a few fibres in its fleece which were partly coloured, but, as the sheep grew older, the bases of these fibres became white, and there was no sign of coloured fibres in the second-year fleece. The trouble, however, may be due to some trace of the English Leicester blood in the cross-bred, since with this breed black lambs occur fairly regularly, and, less frequently, black patches in the wool also may be found. It also may be due to keeping, for breeding purposes, South Down cross it should be eliminated, as it can have no bearing on the mutton question, and can be only a defect in the wool.

1V. Presence of the Extraneous and Deleterious Matter in the Wool.

Under this heading we have the presences of such materials as (a) jute and kemp fibres; (b) Burrs; (c) Sheep-branding materials that will not scour out; (d) pieces of skin: (e) Pieces of hay or straw, etc.

(a) The first of these defects may be due to one or both of two causes from either pieces of string, etc., picked up in a dirty shearing shed, or jute fibres from the wool bales. The former seldom is the cause of the trouble and is easily regulated by a thorough cleaning of the shearing shed before and during shearing; the latter, however, is more serious, and, despite several attempts to produce new types of wool-packs, the matter does not appear to be much nearer solution. So far, all of the new packs that have ~~been experimentally~~ tested have been found wanting in one respect or another. The packs that have been made from paper, string, wool, or other material will not stand up to the dumping, or else will tear badly when hooks areused. The use of a paper lining inside a jute pack was thought to be a solution, and probably would be except for two factors, one being the liability of the paper to tear away from the side of the pack during the pressing, and the other that so long as jute in any form is used, and the packs are unmercifully cut about in the wool-stroes, the jute fibres must find their way into the wool. This question of cutting the bales is a serious matter in the London Wool-stores, which latter I visited for three different sales. The packs are not only indiscriminately cut to display the wool, but, owing to the indifferent shape of the bales after dumping has taken place, in some cases they are cut about in order that they may be tied to supports to allow of safer stacking. The indiscriminate cutting of the bales is not confined to store workers, as some of the buyers, themselves, are guilty of the practice, as during every visitpaid by me to the Stores I observed one or more buyers cutting the bales. One lot of bales, inparticular, was a remarkable object lesson; evidently the bales had been on display at about four previous sales as they had been cut open and sewn together in four different places, and on each occasion a different lot of sewing twine had been used, two lots being somewhat similar to binder twine used for harvesting and condemned by wool-buyers for sewing wool-bales. Why the bales would not have been opened at the same place each time, amd sewn up with seaming twine, is a mystery, unless, it is that it is easier to slash a bale with a sharp knife than it is to cut the string of a previous sewing. So long as practices such as these are permitted in the Wool-stroes, and participated in by the buyers themselves, it does not appear to be very helpful to thewool-producer in his attempts to place his wool on the market as free as possible from defects, and reveals a lack of foresight on the part of the wool-buyer in encouraging the producer to use better packs. When the Prime Minister, the Rt. Hon. G.W. Forbes, during during his inspection of Torridon, askedthe manufacturers' representatives the direct question as to whether if the producers used the improved packs they would receive more for their wool, the reply was in the negative. All the new types of packs so far produced are more expensive than are the jute packs used at present; so the producer is not to be encouraged to use them.

Another point to be noted in this connection is that some bales of wool, after leaving the wool-stores in New Zealand, do not receive sufficient attention as regards the proper sewing-up of openings, or else it is that the bales have burst along a seam during dumping. These openings will allow jute, kemp, and other deleterious materials to gain access to the wool during handling and transport. This could be remedied by NewZealand brokers seeing that all such openings are fastened up before despatch of the bales.

For the sewing-up of woolpacks, and for tying-up of fleeces, the United States Department of Agriculture now recommend a twine made from paper material, as this has the advantage that, if it does get into the scouring bowl, it disintegrates and comes out during manufacturing processes. However, the samples so far produced look rather too thick for quick and easy sewing, and, since we do not tie up our fleeces, any seaming twine gaining accesseto the wool from New Zealand must do so as a result of faulty opening of the bales at mill.

(b) The burrs ofwhich complaint chiefly is made usually are the seed containers ofthe Burr Clover, Medicago hispida; but the burrs of Burdock, Arctium lappa, also may cause trouble, especially in some Poverty Bay clips. Apparently, the manufacturers are not so particular about the seeds of

Piri Piri, or, as it is commonly known, bidi bidi, since these are more easily removed by crushing and carding, although, of course, they would prefer to have wool free from them. When in England I communicated to the Director-General of Agriculture the opinion that certain Bradford merchants hold, that it should be a criminal offence to have burr-producing plants on a farm. This , of course, may be impracticable; but with the advent of improved grazing practice it should be possible to control the trouble to at least a certain extent

(c) The presence of sheep-branding materials that will not scour out has long been the complaint of the manufacturers, and usually, it is attributed to the use of tar, paint, or other similar material. Tar seldom if ever is used as a bradding material in New Zealand at the present time, but paint is used in the cases of some stud breeders who require a number of different **colours to** distinguish mobs of ewes mated with different stud rams. However, it seldom should be necessary to use paint as at least twenty-five mobs can be marked by using a series of dots on different parts ofthe sheep, utilizing the four colours of branding fluids most commonly available namely, black,blue, red, and green. The Wool Industries Research Association has carried out considerable work in an endeavour to perfect a new branding fluid that will remain visible on the sheep from shearing to shearing, and yet scour out, if not in the ordinary scouring liquors, in a special piece-scouring solution. These efforts have met with a certain measure of success, as favourable reports have been received from South Africa, where a dry season was experienced. However, reports from Australia are hardly so favourable from either the point of view of lasting properties on the sheep, or from that of scouring out. The two different sets of samples experimentally tried out in New Zealand have not proved very satisfactory, and from present observations it would appear that this branding fluid, as distributed by a commercial firm last season, already is beginning to show signs of being washed off the fleeces However, the writer has a further series of experimenal samples to try out this seaons, which may be productive of good results. It is expecting rather much of any branding material to expect it to withstand the variations of temperature and rainfall that are experiences in different parts of New Zealand, and still scour out in the mill, although it is just likely that it may be possible.

(d) The pieces of skin left adhering to the wool are the result of t the cutting ofthe sheep by the shearers, and it is a matter demanding a better standard of shearing. While not a really serious matter, improvement in this respect should permit of better economic use of the wool and less damage to the manufacturers' machines

(e) Pieces of hay, straw, etc., also cause trouble to the wool-manufacturer as they not always are removed in the manufacturing processes and a considerable amount of labour, therefore, is entailed in examining the finished goods to pick out small pieces of fibre, and in darning-up the holes.

. Discoloured Wool:

There are a number of discoloration defects of wools that very in their economic importance, some of them being dead-yolk stain; dip-stain; tick marked stain; blue, red, and green colorations brought about by bacteria; canary-yellow discoloration, which, according to manufacturers, has increased in New Zealand during the last few years; discoloration brought about by pressing damp wool, and lime stains on slipe wools.

The dead-yolk stain is more or less common, depending chiefly on climatic conditions during the growing season, and is well-known to most wool producers. This really is not a serious trouble because as a general rule, the wool will scour quite clean and white; but the discoloration detracts from the appearance of the wool when the latter is displayed for sale. Recent work at Torridon by Rimington and Stewart has shown that this ordinary dead-yolk discoloration is not harmful to the wool, and frequently is not associated with excessive amounts of yolk in the wool, but more frequently with lack of air and a high percentage of suint. In fact, the whole trouble appears to be brought about by changes in the colouring matter in the suint. We here have a case where the buyer penalizes the wool-producer by payinga lower price for wool that has not been harmed, and which, as a rule, is as high yielding as is normal wool.

On the other hand, dip-stained wools not only have an unattractive appearance, but in some cases scour a bad colour, and, in extreme cases, the fibres may be damaged so that a bad spin results. The harmful dip-stains usually are brought about by improper mixing of dips containing carbolic derivatives, although arsenical dips also may cause the trouble, which has been somewhat prevalent of late years as some farmers have experienced difficulty in correctly mixing the paste dips that recently have become popular. Only recently, Mr. Leslie, who is the Veterinary Surgeon to Lincoln College, had a case where a big flock of rams were so badly affected by dipping that their wool came off in patches, and the skin was burned. The trouble may not be always due to faulty work on the part of the farmer, but may be due to improper mixing of the ingredients of the dip.

Tick or ked-stained wool is harmful chiefly because of its unattractive appearance, as the wool usually, but not always, will scour quite clean. However, there often is an indirect effect on the wool, due to excessive ked numbers lowering the vitality of the sheep so that less wool is produced, and, in extreme cases , a tender wool may result. More careful attention to dipping the sheep soon should remedy this defect.

A number of coloured wools have been traced to the action of bacteria; blue, red, green, and one yellow discoloration have been traced to this source. The light red discoloration noticed on the tip of some wools, in some instances may be due to bacterial action. However, as the trouble usually is confined to small areas of the wool, and to a very few sheep, it seldom is very harmful. After the heavy snowfall of 1918 one flock of Corriedales in which the writer was interested showed quite a few fairly large patches of blue-coloured wool.

Canary-yellow-stained wools, however, probably are a more serious matter, as the Bradford merchants claim that there has been an increase of this trouble in New Zealand during the last few years. Previously the trouble was prevalent mostly in Queensland and North-West Australian clips; but whether the trouble in these parts is due to the same origin as that of New Zealand wools is not known. The name probably is self-explanatory; but it might be pointed out that the trouble does not appear to have any relationship to the dead-yolk discoloration, in fact, in the case of canary-yellow wool, the actual wool fibres are dyed, and the colour does not scour out. Therefore, any wool having this defect cannot be used for the white or cream goods trade; nor can it be used for high-class dyed goods. There are at least four, and probably more, possible explanations of the cause of the trouble, but so far it has not been possible to prove that any particular one is the causative agent. The first and most likely of the four is that the trouble probably is due to a bacterial action on some portion of the wool grease or the suint, but so far no bacteria that will reinfect other wool under laboratory conditions have been isolated at Torridon from specimens of this canary-yellow wool. However, my reason for saying that this is the most likely explanation is because blue, red, green, and one yellow discoloration have been traced to bacterial action, and, as several colour-producing bacteria may be obtained from canary-yellow wool, it is possible that under a certain set of field conditions they would reinfect ordinary wool.

The second probable explanation is that it may be due to a chemical change in the colouring matter in the wool suint; and that there is a possibility in this is shown by the fact that the trouble usually is worst when a wet season is followed by hot weather. Canary-yellow stain usually is to the most abundantly found on the lower extremities of the fleece, such as the belly wool and the shanks, particularly the hind legs, these being the last parts of the fleece to dry, and probably are richer in suint salts owing to their being carried down the sides of the sheep when the wool is wet, and left there when the water evaporates.

A third explanation is that the trouble is due to the suint or sweat glands, which in action are somewhat akin to the kidney, secreting a dyestuff which has been elaborated in the body or extracted from some of the food the sheep has eaten. While at the Animal Breeding Research Department at Edinburgh, I tried an experiment to ascertain if such a secretion were possible, by giving to some sheep, per month, doses of Methylene Blue, which normally is secreted by the kidneys., However, the time of year- February - was not very opportune for such an experiment, because of the cold, and despite rugs on the

sheep and housing at night, there appeared to be little or no secretion of sweat. Probably, however, it will be worth while repeating the experiment, with certain modifications, in the late Spring in New Zealand (N.B. In Haliburton's Handbook of Physiology 15th Edition, 1920, Pages 610-611, it is pointed out that it is possible for colouring matter, notably bile pigments, to be secreted through the suint glands. There may be some connection between this fact and Canary-yellow wool.)

It has been suggested that sheep-dip may be a possible cause of the trouble, but it cannot be the immediate cause, since the wool usually is stained right down on to the skin, and it is very unlikely that any dipping would have been carried out as late as such a condition would indicate. It is a remote explanation that the trouble may be due to chemical interaction between remnents of a coal-tar dip left in the wool and the salts of the wool suint.

As already has been pointed out, it has not been possible as yet to trace the actual cause of the discoloration, and until this is ascertained control measures cannot be applied. On the surface it does not appear that it will be easy to adopt control measures unless the trouble can be traced to a particular sheep-dip, when one would expect it to be of commoner occurrence than it is at present. If this were the case a change of dip would remedy matters. If bacterial action or chemical change are the causative agents, then it is difficult to foresee any methods of preventing the discoloration.

The baling of wool when it contains excessive moisture causes heat to be generated, and when the temperature sufficiently rises the wool may be slightly charred, and show a brown discoloration; and, if the temperature sufficiently rises the wool actually will burn. The brownish discoloration brought about by moderate rises of temperature in some cases is quite serious, as the wool does not scour a clean, bright white; and trouble also may be caused by irregular dyeing. The heat generated also causes the wool to develop a tendency towards brittleness and harshness, which defects do not permit of the wool being used to the best advantage.

In many cases the farmer has no option but to shear his sheep before they are properly dry, but if this course is necessary he should make every endeavour to see that the wool is not pressed too soon after shearing, and where possible, it should be left in the bins, as open as is practicable, to give it every opportunity to dry. This question of shearing sheep while they are wet opens up another problem that has been worrying Bradford and Continental wool-buyers, particularly of late years, and that is the loss is weight in certain cases between the New Zealand stores and the English warehouses or mills. As it is scarcely likely that all of the trouble is due to inefficient weighing in the NewZealand stores, the only other likely cause is that the raw wool loses some constituent during the voyage to England. The only two possible losses are the wool grease and wool moisture; and even if the former is squeezed out during dumping, it will be absorbed by the bales and so will not be lost in the weight. The other alternative is that the loss is due to evaporation of moisture, and since wool is notoriously hygroscopic, i.e., very readily takes up and sets free moisture, it is quite conceivable that the wool shorn and weighed with excessive moisture in New Zealand may lose some of this excess on the voyage to England.

This problem, however, illustrates the tendency to bias on the part of the manufacturer. He expects to gain weight owing to the percentage humidity of the English atmosphere usually being higher than in New Zealand; so the wool gains weight. The manufacturer never offers to pay for this increased weight because he says he purchased the wool in New Zealand on his estimation of the clean basis of the wool, and a gain in moisture is of no use to him. When it comes to a loss in weight, however, he forgets that it is just as easy for wool to lose water as it is for it to gain it, and that there are equal chances of any mistake in weighing being in his favour as often as it is in favour of the New Zealand store. Since the only loss can be moisture, the manufacturer has lost nothing of value, in fact, he has gained something, as he will have less rail freight to pay in England. The remedy seems to be for every wool-broker in New Zealand to install up-to-date, Government-inspected, dial-recording scales for weighing the wool, and then to refuse to

make an allowance for loss in weight unless the manufacturer, on his part, is prepared to allow for any increase in weight.

Yet another complaint made by some manufacturers is that, occasionally, New Zealand slipe wools are not as carefully treated as they might be, and there is a tendency for a slight, and sometimes a marked, discoloration which may be accompanied by a harsh handle. This trouble probably can be traced to the Sodium Sulphide and lime process used for removing the wool from the skins, and the subsequent use of acid to neutralize the lime, the use of either excess lime or acid being detrimental to the wool, especially when it is not completely washed out. However, it is doubtful if any other depilatory process would prove economical under the particular conditions existing in New Zealand Freezing Works; so it is a matter of being particularly careful in all of the processes of handling the pelts and wool so that as little damage as possible is done to the latter.

V1. RATIO OF LENGTH TO SPINNING QUALITY:

Yet another demerit of some New Zealand wools which the manufacturers have pointed out is that in some instances, especially with the finer half-bred and Corriedale wools, such as 56's, 58's and some 60's, there is a tendency to produce a wool that is too long for the spinning count. It here might be pointed out that cross-bred wool is roughly classified into two classes with regard to length; (1) "preparing wools", which are long shafty wools usually six or more inches in length; but the length may depend to some extent on the count; and (2) "Carding wools" which are too short to go into the former class. After scouring, the preparing wools go through preparing machines in order to disentangle the fibres from their staple formation, and to lay them more or less parallel ready for combing and spinning. After scouring, carding wools are put through the carding machine in order that the fibres may be arranged parallel to one another. While the writer was in England, preparing wools of any description were difficult to sell as compared with carding wools; but especially was this the case with the finer cross-breds; in fact, at that time, very little was being done in preparing wools of 50's count or finer. Thus, all wool of this description has to be either carded with its own quality, when, if the wool is too long, there is excessive breakage, and, therefore, higher losses in the combing process, which means uneconomic production, or else the wool has to be put down a quality or so, which means that the former does not receive the same price as he would if it were shorter. At the Wellington meeting with Lord Barnby, the newspaper report of the proceedings contains, among other things, the following statements; (a) "That once the fleeces reach a 48's count, or finer, length was of relatively little importance." (b) "In the case of fleeces where the average fibre would be classified as of a 46's quality, or below that, length of staple and lustre should predominate."

These statements serve to clearly demonstrate that even manufacturers interested in various divisions of the trade do not always agree. With regard to (a); I was informed by a number of wool experts and manufacturers in Bradford in the case of our finer New Zealand wools, there was necessity for attention to the question of length because of the tendency to produce wool too long for its spinning quality. This is not confined to the Corriedale and half-bred wools, as the manufacturers stated that there was a tendency to produce Romney wool of a 50's count or finer, which undoubtedly was too long. With regard to (b) it should be pointed out that it is irregularity of size of fibre in this class of wool, of which the Bradford manufacturers make complaint, and while length of staple and lustre may be important in some cases, in others, length of staple is of decidedly secondary consideration. The whole question of varying demand, of course, is wrapped up in this problem, as was demonstrated in Bradford last season, when at one period there was an equal, if not better, demand for the shorter carding wools than for longer preparing wools of the same quality. Since there always will be a fairly steady demand for carding wools of our Romney type, it would not be wise for everyone to concentrate on the production of lustrous preparing wools. If the policy of growing long half-breds and fine cross-breds is persisted in, it must mean uneconomic production; and with this class of wool it would be better to aim at slightly shorter but denser wool, if the same quality must be kept, or else grow the same length but of a stronger quality. While dealing with the question of length and quality it might be advisable to point out that the Bradford system of spinning counts is at least a point, if not more, finer than

the designation given to his wool by the average wool-producer in New Zealand, i.e., the wool that a New Zealand producer would designate a 48's, the Bradford trade would designate a 50's; and a New Zealand 50's would be a 56's and so on. This difference, no doubt, accounts for one of the causes of this tendency to produce a wool too long for its quality. An article by Rose on "FINENESS AND LENGTH IN WOOL", in the Journal of the Department of Agriculture, South Africa, Vol.5 No.5, deals with this point.

In an endeavour to assist in overcoming this difficulty, the writer approached the Secretary of the British Wool Federation, Bradford, to ascertain if the Federation could supply the New Zealand Government with a set of samples of the various grades of wool, showing what they considered the correct length for each quality and type.

This appears to be a very formidable list of defects; but it must be remembered that all New Zealand wools do not suffer from many, if any, of them; in fact, it may be safely stated that, when all things are considered, the wools from out best stud flocks reasonably meet the manufacturer's present requirements; and it is with other crossbred flocks that most of the trouble is to be found. This does not imply that improvement could not be brought about so that new and better uses could be made of the wool; but it has to be remembered that in seeking for better quality wools the question of quantity must not be lost sight of. This question of attempting to produce more wool per sheep will be dealt with later, as also will the question of whether or not the New Zealand producer should endeavour to produce a long, strong, lustrous type of Romney.

In Bradford, the general opinion seems to be that New Zealand wool has definitely improved during the last few years, and that if it is possible to continue these improvements there will not be much reason for future complaint with the larger portion of New Zealand wools.

USES OF NEW ZEALAND WOOLS.

It already has been pointed out that it is a difficult matter to ascertain what are all the uses of New Zealand wools, owing to vagaries in the trade; but so far as the United Kingdom is concerned it can be safely stated that the greater proportion of present-day New Zealand wools goes into the hosiery trade. This is in direct contrast with the state of affairs existing about 30 years ago, when New Zealand produced so much lustre wool of the Lincoln and Leicester type that was used in the single yarn or lustre goods trade; also Merino or fine half-bred wool that went into the worsted trade. These facts, for a number of reasons, should be borne in mind, the chief of these reasons being that it is from people interested mainly in the single yarn that the complaints about New Zealand wool have originated, and that in recent years there has not been a corresponding increase in the amount of cross-bred wool produced, compared with Merino wool. It also should be realized that the single yarn or lustre goods trade has been badly affected by the artificial silk industry, and in consequence has fallen off in production during the last few years. The Bradford manufacturers who have been loud in their condemnation of New Zealand Romney wools have recommended that New Zealand producers should go back more to the Lincoln and Leicester types of wool, assuring them that if they did so they would receive a price that would more than compensate them for this action. That they have not put their precepts into practice is demonstrated by the following figures of weights of wool, and prices received for the Canterbury Agricultural College lots for the last two years:-

YEAR	ENGLISH LEICESTER			ROMNEY			IN FAVOUR OF ROMNEY
	Average weight clipped per sheep	Price per lb. at auction	Return per sheep	Average weight clipped per sheep	Price per lb. at auction	Return per sheep.	
1929	10.691 lbs.	10¼d	9/1d	12.061lbs.	11d	11/0½d	1/11½d per head
1930	9.131 lbs.	3¾d	2/10½d	11.051lbs.	4½d	4/1½d.	1/3½d " "

A.L.F. CONT.

NOTE: The 1930 Wool Sale certainly was a "Buyers'" market; and if the manufacturers really had wanted to differentiate in price in favour of good lustre wool, they had every opportunity of doing so. The English Leicester wool would be mostly good bulk 44's-40's; and the Romney would be mostly 48's-46's.

The foregoing figures tend to show that even with Bradford buyers asking for strong, lustroud wools, the price under present conditions is not sufficiently high to warrant the production of such wool. What the future will bring forth no one can tell, as South American exchange rates are affecting to some extent the price of this class of wool.

Both stud flocks quoted in the above table are representative of their breed, and are run under identical conditions; so that the comparison is quite fair. It also has to be remembered that when the Lincoln is used other economic factors are brought in, such as difficulty of rearing the hoggets, and the fat lamb trade.

The manufacturers also fail to realize that now thatthe Romney breed has such a hold in New Zealand the only practical way to go back to the lustre types of wool in what may be considered a reasonable time would be by using lustre-woolled rams on the Romney cross-bred ewes. It is questionable, however, whether this use of lustre-woolled sires would have very desirable results, since it has to be remembered that they are to be crossed on a breed that is condemned by the manufacturer for having certain faults; so that it would take years of careful breeding before the desirable wool could be produced It also has to be borne in mind that the present-day irregularities of some New Zealand cross-bred wools probably are due as much to the indiscriminate cross-breeding that has taken place in the past as to the use of any particular breed of sheep.

Leading sheep geneticists agree that if uniformity of fibre and fleece is what is desired by the wool trade, then it should be more desirable to select types within our present predominating breeds to meet any particular demand, should it be deemed wise to do so, rather than to attempt crossing as a means of producing the class of wool stated by the Bradford men to be required.

Some of the Bradford manufacturers admit that much of the present-day New Zealand Romney and Corriedale wool is excellent for hosiery purposes, and that if the tendency to irregular fibres could be eliminated from a lot of the cross-bred wool, especially that of the Romney type, then it should be readily useful.

The hosiery trade requires a wool that is full handling, soft, well-crimped, bright, with moderately even fibres, and plenty of "life". Quite a wide range of spinning counts are required for the various sub-branches of this trade; so New Zealand is well-fitted to meet the demands; and provided the wool is well-bred and properly nourished, it should quite satisfactorily meet these demands., With the increasing popularity of pull-overs, cardigans, golf-hose, etc., this trade should be fairly stable for a number of years to come. Therefore, before any marked changes in New Zealand wools are contemplated, the law of supply and demand must be considered, and the fact remembered thatall of our present-day production is being used and is meeting a certain demand. Any marked swing in any direction must upset this balance; and there is a likelihood that there may be a reduction in the price of the good wool, with a corresponding increase in the value of the lower-class article. This problem is rendered more difficult by the inability of the manufacturer or anyone else to forecast future demands and requirements. Owing to the number of reasons, one of which is the American Tariff Laws, there has been a fairly brisk demand for coarse wools in recent years, with the result that low-grade wools suitable for this trade have been nearly as valuable as the better-class wools. For how long this state of affairs is likely to continue is not known; but if it were possible to obtain a definite line on future requirements, then it would be a much simpler matter to advise what type of wool should be grown. Probably the most useful advice that can be given is that a farmer should decide on a class of wool that will give him the best economic returns over a period of years, and that he should keep to this type. All this does not mean that improvements should not be attempted as regards existing types, but that there should not be any radical change from these types until such time as it is possible to more

...l understand the exact nature of the requirements of any particular branch ... the industry.

After the hosiery trade, the weaving trade - meaning the production ... worsteds and woollens - probably is the most important user of New Zealand ...ols. This trade requires a very wide range of wool; and here, again, New Zealand is well-fitted to supply these requirements, especially wool coarser than Merino wool. It is extremely difficult to state what are the exact requirements of this particular part of the wool trade, since there are so ...ny sub-branches, some of which have definite requirements, and some of which ... the best wool they can obtain at the cheapest price. Besides this there ... considerable blending of different wools to produce a variety of effects, ...pecially in the Scottish mills. For the better-class part of this trade, ...wever, a very good, well-bred wool, even in quality, free from burrs, etc., ...d with plenty of strength, is the main essential, especially where the wool ...s to be "spun up", and where an even finish and a good appearance are required in the finished article. This trade uses most of our Merino wool, a good deal ... our Corriedale and half-bred, especially the finer classes, and some of the ...tter-class Romney; and as it has a fairly constant demand as demands go in ...e Wool industry, ... probably is the most steady user of New Zealand wools. ...bably the best way in which New Zealand wools could be improved to make for ...re economic use in this branch of the trade, would be by directing attention ... the production of correct length and evener and rounder fibres to a greater ...xtent than is the case at present.

The single yarn trade used to be very important to New Zealand ... so much wool of the Lincoln and Leicester type was produced in this country, ...t now that other influences have made this class of wool unremunerative to the ...verage New Zealand sheepfarmer, this trade plays only a small part in the use ... our wool. The chief requirements of this trade are that the wool shall be ..., lustrous, strong, soft-handling, free from thickened tip or marked fibre ...regularity. If competition in this trade should sufficiently revive and ... promise of there being a ready market for this wool for a number of years, ... there should be every possibility of selecting types of Romneys that would ... the demand if the producer did not wish to return to the Lincoln type.

Certain types of New Zealand wools, especially the coarser kinds, ...so are used to some extent in that branch of the trade which manufactures ...quettes and similar articles for furniture coverings, where one of the ...f requirements is that the material forming the pile shall stand upright, ... easily recover after being crushed; so a fairly good class of wool is re- ...ired. With this may be classed the carpet trade, the requirements of which ... somewhat similar, except that in this case a poorer class of wool frequently ... used; and into this trade goes part of the New Zealand clip having a moder- ...ely high percentage of coarse medullated fibres. According to Dalgety's ...l Review, 1930-31, Page 15, approximately one-third of the world's wool is ... for carpets and other floor coverings.

WOOL RESEARCH.

Within recent years there has been a marked stimulus in research ...k in all branches of production, and both the producing and the manufactur- ... sides of the wool industry have expanded their research activities. In ... case of wool there is a particular need for this research, since it is an ...remely important article of commerce which in recent years has had to meet ... competition from synthetic fibres and a demand for new and improved fabrics. ... strange but true that, although wool for such a long time has been used ... manufacturing purposes, and although such wonderful advances have been made ... the practical man in perfecting machinery for handling to the best advantage ... different varieties of wool produced, until quite recent years comparatively ...le was known about the intimate structure and characteristics of the wool ... itself. A great deal more remains to be learnt about the fundamentals of ...ool fibre before it will be possible to account for all of its peculiarities. ...st be remembered that wool, as an article for manufacturing purposes, ... is a by-product, its primary use being that of a protective covering for ... animal on which it grows; so the wool-producer first of all has to remem- ...er this fact and then endeavour to grow a class of wool that will afford the ...t protention for his sheep, combined with qualities that will render it most ...ful for manufacturing purposes. In the past there has been a tendency to ...sider only that wool grew as a covering for sheep and that when manufactured it

produced an excellent material for making clothing, but now the time has come when both the wool-producer and the manufacturer must consider ways and means of improwing wool and producing new varieties of finished material.

Raw wool is produced under such a wide variety of conditions of soil and climate, the latter varying from year to year, that it is not- nor is it ever likely to be - possible to produce a uniform article. The result is that wool required skilful handling and manipulation by highly-skilled workmen through all the manufacturing processes; and, consequently, manufacturing costs often are higher than they should be. Contrast this with synthetically-produced fibres, such as artificial silk, which is produced in a factory under standard conditons, nearly all of which can be varied at the will of the producer, so that a variety of articles can be produced ,each of which is suitable for some different use in the industry. This results in the production of a more or less definite article which can be relied on to behave in a definite manner under a given set of conditions, so that during subsequent manufacturing processes there is not the same demand for highly-skilled and well-paid workers.

Although a certain amount of wool research had been carried out in England prior to the Great War, it was given a considerable stimulus after the War when the Wool Industries Research Association, which has its headquarters at Torridon, Leeds, was inaugurated. This Association originally was established to deal with problems confronting the manufacturer, and was supported by the industry;but it soon became evident that before many of the manufacturers' problems could be correctly solved it would be necessary for a good deal more to be known about the fundamentals of the fibre than was then known. Consequently, the Association is now financially assisted by the Department of Scientific and Industrial Research and the Empire Marketing Board; and within the Association there are departments studying biological problems, such as the growth of hair "in vitrio" genetical problems, such as the inheritance of kemp in the fleece of the Welsh Mountain Breed, physical and chemical investigation of the fundamentals of the wool fibre itself, physical and chemical investigation of manufacturing problems, investigation of problems in connection with dyeing and a study of actual manufacturing problems of scouring, carding, spinning, etc.

The work on the fundamental problems of wool growth and its structure are of semi-direct interest to the wool-producer, since this work is essential if distinct progress is to be made by the manufacturer in his understanding of the reasons for different wools behaving in different manners. The manufacturing community still provides a large portion of theincome of the Association, and, as the management largely is in the hands of the manufacturers, the work being undertaken is of interest chiefly to the manufacturer, and as yet not much work has been carried out that is of direct interest to the primary producer. Admittedly, many of the problems of the producer can be best undertaken inthe various countries concerned; but there are certain fundamental problems, the investigation of which could be best undertaken at a central institute such as Torridon. The chief of these problems undoubtedly is the question of working out some method by which a complete fleece may be correctly sampled, so that satisfactory results may be obtained from analysis of wool grown under special conditions. That this is an essential piece of work is emphasised by the results obtained by Bonsma (WOOL RECORD, July 24th, 1930), in his work on the determination of grease, suint, foreign matter, etc., present in wool, and similar results of Messrs. Scrivener and Sutton. (Reports, NEW ZEALAND DEPARTMENT OF SCIENTIFIC AND INDUSTRIAL RESEARCH, 1930). Another matter requiring attention is the question of the particular requirements of any one branch of the industry, and this work would be helpful to those engaged in research at the producing end, and might assist in preventing misdirected attempts at wool improvement.

The work carried out at Torridon that is of most direct and immediate importance to the primary producer undoubtedly is that on branding fluids, improved wool-packs, and examination of raw wool. The questionof branding fluids already has been dealt with under the head of defect brought about by using unsuitable materials for this purpose. However, it might be well here perhaps to point out that two experimental lines sent out for trial in New Zealand did not prove satisfactory under Canterbury conditions. From observations made at the present time (May), it would appear that the new fluid made accord-ing to the formula supplied by Torridon, and sold by commercial firms last season, does not promise to be visible from shearing to shearing, especially in the case

of long-woolled sheep. The question of woolpacks also has been discussed elsewhere; and all that need be said here is that there still remains a good deal of work to be done on the problem before there can be placed on the market what can be claimed to be an improved pack from the practical point of view. The work of fleece examination also has proved useful in that it has thrown some light on defects of wool such as irregularity of size and shape of the fibres. In this connection the work carried out and reported in Publication No.115 of the Wool Industries Research Association - "MEMORANDUM ON PHYSICAL ANALYSIS OF THE ROMNEY, CORRIEDALE, AND ROMNEY-CORRIEDALE CROSS-BRED FLEECES". was done in an endeavour to assist the New Zealand wool-producer However, in the report no mention is made of the origin or history of the fleeces used; but, from the samples still at Torridon, it is evident that the Romney fleeces (two in number) were of English origin, that the two fleeces used as Corriedales certainly were not true to name and more probably were an off sort Leicester, and that the Romney-Corriedale might have been anything, and certainly contained an admixture of fine and coarse fibres, many of the latter being medullated. It is unfortunate that more fleeces of known history were not used in this piece of work, since the results obtained are misleading according to my examination of the New Zealand Romney and Corriedale fleeces, where there was as much variability and irregularity of shape in the Corriedales as in the Romneys.

The work of examining different types of raw wool still is being continued, and a certain amount of work has been carried out on working out methods of analysis. The genetical work of Roberts on the inheritance of kemp in the Welsh Mountain breed is of particular interest to the breeders of this sheep; but it also may have some bearing on selection work in the New Zealand Romney, when it is based on birth-coat characteristics.

Other institutions that are carrying outsome work in connection with wool research are: The Animal Breeding Research Department, Edinburgh University; The Rowett Research Institute, Aberdeen: The Textile Department, Leeds University: The Textile Department, Bradford Technical College: The North Wales University College, Bangor (in co-operation with Torridon); and other technical colleges in the textile districts are carrying out a certain amount of work, but on the manufacturing side.

Originally, the sheep work at Edinburgh was concerned mainly with genetical problems, such as the inheritance of colour, but of recent years it has turned more in the direction of biological and physiological problems concerned with the growth of the fleece; but the genetical side has not been lost sight of. Of the biological and physiological problems a considerable amount of work has been carried out, and still is being carried out, on the periods of growth and shedding of the various types of fibres found in the Scotch Blackface fleece; and at present work is being undertaken on density determinations; A good deal of work also has been undertaken on the influence of thyroid activity on the characters of the fleece; and from the work carried out to date it would appear that the thyroid has a direct influence on certain fibre characteristics. For example, after thyroidectomy, the coarse, hairy, medullated fibres from the Scotch Blackface fleece considerably thin down, and, in most cases, lose most if not all of their medulla, and, to the naked eye, they partly resemble true wool fibres. As already has been pointed out, this question of thyroid activity may have some connection with the production of medullated fibres in the New Zealand cross-bred wools. In Dr. S.G. Barker's paper to the Imperial Wool Research Conference, 1930, he states: "Nutritional research points to Iodine as being a limiting factor upon which the utilization of sulphur in this way (even though cystine is amply available in suitable form) depends." The thyroid gland is associated with the control of iodine in the body; and if the above statement is correct, then it is conceivable that this may be a contributing cause to the production of so much medullated fibre in certain New Zealand cross-bred wools.

Despite the increase in physiological studies, genetical work has not been neglected, but is concerned mainly with the inheritance in the Scotch Blackface Breed of kemp in the fleece and black spotting on the face and adjacent parts. Colour inheritance, which was commenced by Ewart and continued by Roberts, still is being persevered with; and while it may not at present have any direct bearing on producers' problems in the Dominions, ultimately, it will have an indirect bearing as the science ofsheep genetics is as yet in its infancy.

Mr. Miller, who has charge of the sheep work at Edinburgh, also has carried out considerable work in an endeavour to either confirm or refute the statements of Serge Voronoff, that by means of testicular gland grafting it is possible to increase vigour, growth, and the quantity of wool produced, and, in addition, to rejuvenate valuable aged sheep. So far the work at Edinburgh and similar work in France has led to the conclusion that when young rams are operated on there is a temperary stimulus to vitality for a few weeks subsequent to the grafting operation, but after this the stimulus dies away and the experimental animals are no better than the controls. As far as rejuvenation of aged sheep is concerned, it is a much more difficult matter to obtain reliable information as to the efficacy of the treatment, since it is always questionable whether the animal would have proved fertile had the operation not been carried out., However, in a paper report from South Africa, it was claimed that beneficial results had been obtained with old stud rams, although reports from other countries have not shown that good results were obtained following grafting.

The Rowett Research Institute has undertaken, and still is undertaking, a certain amount of work on sheep nutrition, both as it affects the animal, in general, and thewool, in particular. So far no results of this work have been published, and the work may be said to be still in its infancy. One of the big problems that they have close at hand is that of supplying the hill sheep on the poorer hill grazing in Scotland with supplementary protein and minerals. The results to-date apparently have been quite satisfactory, and the work of carrying out the feeding has been somewhat simplified by having their supplementary ration made up in cube form so that it can be conveniently fed to the sheep. There is little doubt that if the process of making cube foodstuffs in New Zealand could be economically carried out, it should be very beneficial to the farming community as it should considerably help in the winter feeding of both sheep and cattle. The total yearly production of both of these classes of livestock is considerably reduced owing to insufficient protein and mineral matter in their winter rations.

The Textile Department of the Leeds University has been carrying out various phases of wool research for a number of years, but as the department is organized primarily for educational purposes on the manufacturing side of the industry, the research necessarily has been mainly on manufacturing problems. Of recent years more time has been devoted to work on fundamental problems connected with physical and chemical aspects of the wool fibres, particularly X-ray examination of wool by Mr.Asbury; and this work promises to give very good results. Mr.Speakman, among other things, has evolved a method of obtaining a mathematical measure of the scaliness of wool fibres, and this may be useful in any work that may be done in the direction of improving the handle of our New Zealand wools.

A certain amount of attention also has been paid to problems of more direct interest to the producing side of the industry; and probably the most notable example in this connection is Dr.Dry's work in connection with the inheritance of black fleece in the Wensleydale. In New Zealand we have a somewhat similar but not so marked a problem in the English Leicester breed, which produces a moddrate percentage of black lambs each year. If it is thought desirable to eliminate these black lambs, selection along lines similar to those recommended by Dr. Dry in connection with the Wensleydale, i.e., selection of copper, rather than blue, face and ear colouring, will be successful in eradicating the undesirable blacks. Here, again, however, the influence of the showyard probably will diminish the advantages to be obtained. Professor A.F. Barker and his colleagues have carried out a certain amount of work on the manufacturing possibilities ofthe wool produced by the various breeds; and in this connection I understand a report has been prepared on some wool supplied some few years ago by the New Zealand Government.

The Textile Department of the Bradford Technical College also has been carrying out a certain amount of research into problems confronting the manufacturing side of the industry, combining this work with their educational activities. So far a good deal of their work has been centred on making more chemical use of wool, especially by-products such as noils and shoddy. A good deal of attention is being paid to this question of the use of shoddy and similar products at Torridon, Leeds University, and Bradford; and while this is quite satisfactory so far as the manufacturers are concerned, it really is working against the producing side. The more machines and processes perfected

r the treating of this class of material, and the better uses to which their subsequent product can be put, will mean that these products will either displace and/or reduce the price of raw wool. Whichever happens it means that there will not be such a stimulus to the improvement of theraw wool.

The University College of North Wales is collaborating with the l Industries Research Association in the genetical work that is being done in connection with the attempt to eradicate kemp from the fleeces of the Welsh ountain sheep. This is a definite problem of wool improvement that has been tackled from the genetical point of view ,with the result that by selection along definite lines it is possible to eradicate much of the kemp from the fleeces of this breed. It has been a particularly interesting experiment/ s far as the wool-producer is concerned, in that it has clearly shown that before rushing into any selection work it is very necessary for the investigator to carefully look into the matter and to consider otherfactors besides wool improvement before making any recommendations to the practical farmer. One of the first conditions noted in this piece of experimental work was that the lamb whose birth-coat was either free or almostfree from kempy fibres subsequently produced a wool that was free of kemp; and selection along these lines seemed to be the obvious course. However, the practical farmer maintains that a kempy birth-coat is essential as a protention for the young lamb during the first critical days ofits life, especially on the higher hills where storms frequently are met with during the lambing season. This objection made it essential that a closer study be made of thelambs with kempy birth-coats to see if different types could not be distinguished, and if one of the types would not yield a subsequent fleece relatively free from kemps. This has been done, and the process now is under way of building up a strain ofthis hardy breed with a relatively low percentage of kemp in the adult fleece.

Despite all this research work little serious attention is being paid to the question of wool improvement in the sheep of the Birtish Isles because of the fact that carcasesqualities are becoming increasingly more important; and thefarmer considers it is not possible to grow really good wool and at the same time produce a hardy, good-caracsed, early-maturing sheep. Professor R.G. White's paper to the Imperial Wool Research Conference, 1930, puts the matter very clearly, and there is no doubt that his remarks have a certain application to NewZealand conditions as well. Items Nos.6 and 7 in particular, of this Paper, very lucidly express why the British sheep-breeder is so indifferent to wool improvement, and why wool improvement the world over has not been so vigorous as it might have been. There is in existence in England and Scotland a Wool Breeding Council whose object it is to bring about wool improvement, but so far the results of theexperiments carried out to-date under the supervision of this body do not appear to be very satisfactory. These experiments also clearly illustrate thenecessity of taking a very wide view of the question of wool improvement, and remembering that the first essential of a sheep is that it shall live underthe particular conditions prevailing in any district or country.

One of the experiments tried was the introduction of Merino rams in an endeavour to produce better wool, but although in some cases there was an improvement in the wool, it soon was found that, as a general rule, sheep with the Merino cross were not as profitable as were the existing breeds, and in many cases were found wanting in constitution and general ability to survive the hard conditions that prevail in those parts of the British Isles where breeding for wool might be a possibility. Another experiment tried was the crossing of the South Down on the Scotch Blackface; but this experiment hardly can be said to have achieved its object as the wool of the cross-breds was neither so suitable for the carpet trade as was the Blackface wool; nor could it be profitably used for any other trade requiring a wool of a fairly high standard. It also was found that the cross-breds from this cross were not really satisfactory for living on the poorer Scottish hills.

The wool-producer in England is not alone inbeing slow to take advantage of the results of research work, for many of the manufacturers are almost as tardy, if not more so. Certain of the manufacturers who have a keen interest in Torridon or some other institution carrying out research work, undoubtedly have put into practice thefindings of research work. It cannot be claimed, however, that these men are in the vast majority, because in a number of factories the findings of Torridon, etc., hardly ever are known, and in some, if they are known, they are scoffed at. At the present time, in nearly every

branch of industry, scientists are employed to check the raw ingredients, the various stages of manufacture and the final product; but this is scarcely true of the Wool industry. The writer visited quite a number of wool-processing mills in England and Scotland, and in one only was a technical person employed to check any of the work; and this person was carrying out an extremely elementary piece of routine work. The wool-manufacturer complains of the extreme variability of his raw product; but it well may be asked if he in his turn is doing everything possible to assist in effecting a remedy. One thing that must strike an observant visitor as he passes through a wool-scouring plant is the somewhat rough and ready method of adding fresh soap solution in dipperfuls and part dipperfuls to the scouring liquor when the operator considers it necessary. A manure-manufacturer soon would find himself in trouble if he followed similar methods in his production; and yet this matter of the strength of scouring liquors is only one of many in the scouring-mills with the methods in connection with which one might find fault. In fact, it well may be said that the Wool Industry still is mainly in the hands of the so-called practical man, who, quite often, is a traditionalist, frequently relying on the methods of his predecessors. The manufacturer also asks for improved wools and for wools of a different type from those he is receiving; but it is very questionable if it would not be, in some cases at least, a more economical and satisfactory proposition if the manufacturer were to adapt his machinery to the wool that the farmer is able to produce, rather than ask him to produce something the production of which may border on the impossible. In this connection paragraphs five and six of Professor Crew's Paper to the Imperial Wool Research Conference, 1930 (Official Report of Proceedings Page 85), very clearly bring out this point.

RESEARCH METHODS.

Two of the first essentials of any piece of experimental work are to plan the work to reduce errors and to be able to accurately measure, with reasonable rapidity and economy of labour, the results obtained from the work. From the results of experiments on animals carried out for other purposes, it is now possible to carefully plan any experiment with regard to wool production; but the big difficulty is to be able to correctly measure the results. Probably the greatest difficulty in this respect is that, up to the present, there is no reliable method of sampling a fleece. Since wool fibres vary considerably, not only in different parts of the fleece, but also in neighbouring locks or staples, sampling is one of the first essentials in any piece of experimental work in connection with wool production. There also is the fact that some woolcharacters, such as elasticity and weight, vary with changes in humidity and temperature; and unless these factors can be adequately controlled much experimental work may be useless. In fact, lack of control of these two important conditions makes much of the research work done in the past of very little value.

One of the big problems in wool research is the measurement of the dimensions of wool fibres; and here there is a need for much improved technique. For example, in the measurement of the true length of fibres, there is the necessity for removing all crimps from the wool without stretching the fibres beyond their normal length. A few methods have been tried to overcome this difficulty, but so far it cannot be claimed that any of them give really reliable results. For the measurement of fibre thickness, there are a number of methods employed, but all have their failings. Method using direct microscopical or caliper measurements measure only one axis of the wool fibre, but permit of measurements at different points along the length of the fibre. Where cross-sections are cut both axes can be measured, but at only one position along the length of the fibre; the method also is slow and requires considerable skill; and there always is the liability of slight distortion of the cross-sections during the many processes through which they pass. Length-unit weight measurements measure the average cross-sectional area of the fibres of the whole sample, but tell us nothing about the variation in, or irregularity of the size of, fibres. Wools containing any quantity of medullated fibres cannot be accurately measured by this means.

In any experiments in connection with the feeding of sheep, or other wool studies, one of the criteria used to measure the results is the tensile strength of the fibres. Here, again, the question arises as to whether or not the present methods of carrying out this work give satisfactory results from the point of view of those carrying out the feeding trials.

From these few remarks it will be seen that the laboratory examination and interpretation of field experiments in connection with wool improvement is anything but a simple matter. Until such time as the work is placed on a sounder basis, there always must arise the question of whether or not the results obtained are accurate, and, if so, where do they lead in practice.

OTHER FACTORS AFFECTING WOOL IMPROVEMENT

Parasites affecting sheep;

One of the factors limiting the total production of wool by young sheep, and a contributing cause of fibre irregularity, is the question of the effects on the general health of the sheep of such parasites as stomach, intestinal, and lung worms, flukes, and, to a lesser extent, ticks or keds, and lice. The determination ofwhat is the best and most economical treatment for the eradication of all classes of worms is one of the most important problems awaiting research in New Zealand, since, to the farmer, the loss is heavy by deaths, lowered vitality of surviving sheep, and lowered production of both mutton and wool by the ravages of these pests.

Parasitic Diseases:

At the present time, Copper Sulphate and Arsenical compounds are the chief medicinal remedies, especially when proprietary medicines are used for combating these parasites in New Zealand. These compounds are effective for treating stomach worms, but are not so satisfactory for intestinal worms and flukes. At the present time a good deal of work is being undertaken in England and America towards trying out new compounds for use in worm eradication. The most notable of these compounds are Carbon tetrachloride and Tetra-chlor Ethylene; but so far it does appear certain which is the more effective and safer compound to use. There are two objections to their use, however, one being the expense involved, and the other that so far their toxicity is not properly understood, since in a large number of cases there may be no harmful effects, but in a few cases there may be a large numberof deaths. According to newspaper reports liver fluke is on the increase in Hawke's Bay and Poverty Bay; and if this is so, then there is every necessity for carefully trying out Carbon tetrachloride under New Zealand conditions in an endeavour to prevent the trouble spreading and becoming more serious.

Ticks, Bice, and Dipping;

Annually, these are the cause of a good deal of loss and trouble to the New Zealand sheep-farmer, and in recent years there has been considerable trouble in some districts through the presence of lice on the sheep, especially where some paste dips (carbolic derivatives) have been used. Lice do not have a direct effect on the wool, but have an indirect effect through lowering the vitality of the sheep, thereby reducing production, and by causing the sheep to rub against fences, etc., with resulting damage to the wool. Ticks or keds have the same indirect effect, and in addition have a more direct effect in that they stain the wool, not harmfully, but so that it is not so attractive when submitted for sale. What really is required in New Zealand is a sheep-dipping material really capable of effectively dealing with both keds and lice at the same time and which is easily mixed.

There is no doubt that the process of dipping should be more carefully carried out than often is the case in New Zealand, not only for the more efficient control of parasites, but also to lessen the amount of dip-stained wool appearing on the market, and the deaths or damage to sheep. The harmful dip-stains usually are brought about by improper mixing and use of dips of the coal tar derivative type; and there probably has been a slight increase of recent years owingto the difficulty experienced by some farmers in correctly mixing the paste type of dips which of late yearshave become so popular..

Mycotic dermatitis (or lumpy wool).

This is a communicable disease of the skin of the sheep, so far not observed in New Zealand, but found in various parts of Australia and South Africa, and might be introduced in imported stock. It is characterized by the exudation of a wax-like material from the skin of the sheep, the exudation

hardening to a substance not unlike soft horn, so that the wool is very unattractive, and, in extreme cases, it is not possible to shear the sheep.

Feeding and General Management:

As yet, little is known in regard to the effects of various foods on wool production and wool quality; but it is well-known to most farmers that if a sheep passes through a period of semi-starvation, and, later, is well fed, during the period of shortage there is a diminution in fibre diameter which, if it does not result in a definite break in the wool, will at least mean that the wool is tender, and, in consequence, not so valuable as is sound wool. What probably is the most necessary step to be taken in New Zealand at present is to endeavour throughout the year to even up the food supply of the sheep;, and by means of improved methods of grazing and saving of hay or ensilage from the grass during periods of flush of growth, this can be accomplished. Such better feeding will not only result in the production of an evener-fibred wool, but should be helpful in improving the fat lamb production and in lessening the likelihood of the serious effects of parasitic diseases

Since we know little about nutritional effects on wool, it is somewhat early to hazard any opinions as to how our present feeding standards might be altered so that more and improved wool may be produced. It already has been pointed out earlier in this report that there is a possibility of there being some connection between the sulphur content of New Zealand pasture grass, and the tendency towards the production of medullated fibres in the wool. Around this point hinges the whole question of in what form the sulphur must be in the food of the animal before it can be converted into the cystine that is found in wool. It is claimed that, in some cases, the feeding to sheep, especially during periods of scarcity, of animal or other by-products supposedly rich in cystine; has a marked effect on wool production. These experiments, however, appear to fail in that, from the results so far published, the cystine-rich foods has not been checked against the feeding of the feeding of similar sheep with a ration of the same nutritive ratio and energy value, but containing little or no cystine. If one experimental lot has only the ordinary food that is available, and another lot is fed an additional ration which is claimed to be rich in cystine, and the latter lot should produce more or better wool than does the former, it is not fair to conclude that the improvement is due to the cystine content of the supplementary food. Any other food that would raise the plane of nutrition of the sheep might bring about an exactly similar effect at a lower cost.

There also is the question of the effects of mineral deficiency on wool production; but here again little is known. Of course, where the deficiency is so marked as to affect the condition and thriftiness of the sheep it must have an effect at least on the amount of wool produced per sheep, but whether or not mineral deficiency itself has any effect on the production of irregular fibres or objectionable wools has yet to be determined.

WOOL IMPROVEMENT IN NEW ZEALAND.

When any scheme of wool improvement is contemplated there are a number of points that must be carefully considered before any radical changes are brought about. Among the points that must be considered in New Zealand are whether, if we produce better wool, that wool will prove as effective a protective covering as what we are producing at present, whether it will meet a ready market, and whether the price received for it will be such that it is going to pay the farmer to produce this type of wool; also whether the sheep that produces this wool will be as constitutionally strong and an equally efficient a mother for producing fat lambs as are our present type. The question also arises as to whether the change in wool type will alter the supply of the different classes of wool in such a way as to unfavourably upset our present balance of supply and demand. Behind all this, of course, there lies the question of what is going to be the supply of, and the demand for, fat lambs in the future, and what class of wool is going to be the most profitable to produce. Although there has been an increase in the demand for fat lambs in recent years, it is doubtful whether the demand will increase in the same steady rate in the future. There appears to be every likelihood of the supply increasing and the type improving within the next few years, as both Australia and the Argentine appear to be paying more attention to fat lamb raising.

In no other country has wool improved so much in the last twenty years as it has in South Africa; and there the credit for effecting this improvement is given to the work of the Sheep and Wool Extension Officers of the Department of Agriculture, whose duty it is to help the sheep-farmer in every way to improve his breeding practices, general management of the sheep, and the preparation of his wool for market. In New Zealand something similar is required since it is not of much use the stud breeders improving the class of wool if some of the breeders of cross-bred flocks do not employ better methods of breeding and management than is the case at present. As already has been pointed out, some at least of the present undesirable wool probably results from the indiscriminate cross-breeding that has been practised in the past. This indiscriminate cross-breeding has not been confined to crossing of different breeds, which, of course, is the worst type of cross-breeding, but also has included the crossing of different types within the same breed. If universal wool improvement is to be the aim in New Zealand, then one of the first steps should be to demonstrate to the producer the necessity of selecting a type of sheep most suitable to his locality and keeping to this type as near as is possible by selecting similar, and, if possible, related rams each season. So long as the breeding practices outlined below are persisted in in this country, there always must be a certain amount of irregular wool. At the Conference at Bradford, in June, 1930, between the British Wool Federation and some New Zealand wool-producers, one of the latter explained his system of breeding, which was to use Romney rams on his cross-bred ewes, which latter had a preponderance of Lincoln blood, and Lincoln rams on these ewes having a preponderance of Romney blood. This type of breeding, which is not uncommon in certain North Island flocks, surely must lead to a very mixed class of wool being produced, with the probability that in the wool of even a single sheep there will be a big variation in fibre diameter. A Southland farmer has a system of breeding whereby he uses, one year, 25% Corriedale rams and 75% Romney rams; the next year 33% Corriedale and 66% Romney; the next 50% Corriedale, and 50% Romney; the next 66% Corriedale and 33% Romney; the next 75% Corriedale, and 25% Romney; and then starts and goes back down the scale again. A system of breeding such as this, with uncontrolled mating of the rams and ewes, surely must lead to a mixed class of wool and sheep.

In many recent publications a good deal of stress has been laid on the necessity for judicious inbreeding if an even line of any class of stock is to be produced; and this particularly applies to the sheep-producer if he desires to produce throughout his flock an even class of wool as free as possible from defects. With some stud breeders in the past there has been a tendency to buy rams from a number of different flocks; but if wool improvement is to advance this practice must cease, and either home-bred rams whose breeding is known, used, or else, if outside rams must be obtained, they should come from one particular strain. The average breeder of cross-bred sheep, however, is not in the position of being able to inbreed, but he can more or less line-breed by using one stud-breeder's rams, and if these are retained it will mean moderate inbreeding in the course of time.

Probably the most outstanding defect requiring correction in some New Zealand Romney wools is the tendency to produce medullated fibres; but so far little or nothing is known of the genetical factors involved in their production. Until something more is known about the inheritance of medullated fibres, and what will be the effect of completely eliminating them from the fleece, it will be difficult to recommend any measures likely to prove effective in aiding the stud breeder to eliminate this defect. When speaking of the inheritance of kemps in the Welsh Mountain breed, I have pointed out that before making a recommendation to the practical breeder a very close study must be made of all factors likely to appear in the work. Work carried out at Massey College has produced a means whereby the stud breeder can quite readily determine whether there is medulla . . in the wool of any particular sheep; but since we know nothing of the inheritance of medulla, it does not necessarily mean that because there is no medulla in the wool of a stud sheep the factor for its production is not carried in the germ plasm. It may be, therefore, that a ram showing a very fine medulla in his wool, such medulla being more or less harmless, may be as good a breeding sheep as, if not better than, a ram showing no medulla, but carrying in his germ plasm the factor for very coarse medulla which is definitely undesirable.

There also is the question that if all medulla is eliminated, may there not be a tendency to produce a wool that is too soft to withstand the hard conditions and wear to which it is subjected on some of the less developed sheep farms? The Romney breed serves this type of country; so no steps must be taken that are likely to lower the usefulness of the wool as a protective covering. In addition, as yet it has not been possible to correlate the production of medullated fibre with nutritional and climatic conditions; but there appears to be good ground for assuming that they at least play some part in the appearance of these undesirable fibres. If this is so, then selection work on a single year's fleece may give quite erroneous results.

If we consider for a while and endeavour to ascertain which classes of livestock have most improved in actual production during recent years, it soon is evident that dairy cattle, beef cattle, and utility purpose fowls show the most marked improvement. In the case of dairycattle and fowls the improvement has been brought about by testing individual animals and then breeding from high-producing strains; while in the case of beef cattle the production is partly obvious to the eye; and the fattener alsm more or less closely watches the rate of growth of each animal. In more recent years, pig-testing has considerably assisted in increasing pig-production, especially in Denmark, while, recently, honey-bee and draught-horse testing has been commenced If the wool-producer is going to keep pace with the times some form of measuring the wool production of stud sheep will be necessity. With sheep, of course, the matter will not be so simple as with dairy cattle, poultry, and pigs, because of the number of variables that are associated with wool production; but such difficulties as do exist should not deter a commencement from being made with the work. Any system of wool testing is going to mean the taking of samples for grease determination; and these samples also might be used for stating whether or not the wool contained irregular fibres. By this means it should be possible to sell rams with a certificate as to the weight of clean wool they produced, together with the weight of wool produced by their sires and dams, and the general average of the flock.

There also is another aspect of testing work as a whole, and that is the effect it has on the breeder's general management of his animals. Once testing is commenced it introduces the element of competition, an endeavour to do better, and a more careful watch is kept on theindividual animals, with the result that the whole system of management, especially in the direction of better feeding, is tightened up and better selection and breeding methods are employed.

The following figures taken from the weights of raw wool clipped by the various stud flocks at Canterbury Agricultural College, show the variations existing in the wool-producing capacity of individual sheep within stud flocks, and the necessity for some system of breeding from the best.

If some form of wool testing and selling rams on a certificate is introduced, it should be reinforced by action on the part of the Breed Societies or other interested Bodies, in the direction of preventing the sale of inferior rams. The English Kent or Romney Marsh Sheep-breeders' Association has a scheme whereby every lamb bred from stud ewes must be tattooed by an official inspector of the Association; and the breeder must be able to give the number of the sire and the dam of each lamb. If this inspector had the right to refuse to tattoo undesirable rams, it would assist in preventing the sale of such animals. The English South Down Society have another scheme whereby a levy of five shillings per head must be paid on all male sheep bred from registered flocks and kept entire. Naturally, this has the effect of preventing rams of questionable value from being kept for breeding purposes. A combination of these two schemes in New Zealand would be a step in the right direction, if it were possible to prohibit the sale by auction of non-registered rams. With the idea of improving the Welsh Mountain Breed, the Ministry of Agriculture have a shceme for subsidising selected rams to act as premium rams in certain districts. Each breeder is allowed to send ten ewes to the ram at a fee of about half-a-crown a ewe, the maximum number of ewes allowed per ram being sixty. A somewhat similar scheme in New Zealand to help some of the smaller breeders should be a step in the right direction, especially if those sending ewes to the rams were helped by good judges in selecting the right type of sheep, and the rams were selected for quantity and quality of wool.

The whole scheme is an ambitious one; but it is not an impossible one, and would be a step in the direction of improvement of both quality and quantity of the wool in our stud flocks. It may be necessary to commence the work of wool testing in a few of the leading studs, so that the effects would gradually spread throughout the other flocks; and even if flock rams could be sold on a certificate that the average production of clean-scoured wool in the flock was up to a certain standard, it would be a progressive step.

The manufacturer also asks for a softer-handling wool, because such is necessary in any attempt to produce fabrics to compete with art silk; but how far it is possible to produce this wool and still maintain a fleece of good weight and capable of standing up to our climatic and grazing conditions, is a matter that has yet to be investigated. However, any endeavour to improve the handle of New Zealand wools should also lead to the production of an evener-fibred wool; and the reasons for this already have been pointed out. While dealing with this point it might be well to stress the fact that in any selection for soft handle it might be better if the handle were judged on the scoured, and not the greasy, wool, since in some cases the yolk has a tendency to mask a moderately harsh handle.

The necessity for greater care in dipping and in the control of parasites already has been stressed to a sufficient extent.

With regard to the occurrence of brown fibres in New Zealand slipe wools, due to the use of Down sires, the obvious method to overcome the difficulty and still maintain the South Down breed as the sire for fat lambs, is by selection against the occurrence of coloured fibres in the stud flocks. This work probably would follow similar lines to that already indicated by Dr.Nichols for the Suffolk breed, in England. With so many small flocks of mediocre quality sheep breeding rams for the fat lamb trade, the work will not be easy unless the South Down Society are careful in the granting of certificates and transfers to stud sheep, and judges at the Agricultural Shows are alive to the position.

So far as the coloured fibres in the cross-bred clips from Hawkes Bay are concerned, the best counsel that can be given is to rigidly select against coloured fibres wherever they are found. It has to be remembered that a white sheep is not an Albino, but really is a coloured sheep in which pigment formation is inhibited, and when this control tends to relax, coloured fibres, either individuals or patches, make their appearance.

The presence of extraneous and deleterious matter in wool does not really call for wool improvement, but rather for more careful management of the sheep and care in the handling of the wool.

The correction of the fault of the wool being too long for its spinning quality is simply a matter for selection ofthe breeding stock so as to overcome the difficulty.

The few facts outlined so far chiefly are of a practical nature, and with immediate application to the producer; but concurrent with this work should be carried on more fundamental pieces of research work on the production problems that affect New Zealand. In the past, fundamental work has been more or less neglected by all countries, and it is work that mustbe done now, so that when either the average stud or cross-bred flock is raised to a certain standard of perfection by making use of our present knowledge,there should be new methods available to still further improve matters.

The most urgent of these fundamental problems is one that already is under way in New Zealand, i.e.,the study ofthe inheritance of desirable and undesirable fibre types in the Romney breed, but this might be extended in a modified manner to include other breeds, especially the Corriedale. To obtain the most reliable results, probably the most satisfactory way in which to carry out the work would be to fix in small flocks one type of wool or peculian characteristic by inbreeding, and consequent culling for a number of generations. When these sheep breed true for any particular character, cross-breeding of the different types will show which characters are dominant and which recessive. To the work that already is being carried out under this heading should be added that of endeavouring to produce a strain of Romney with an evener and more circular-shaped fibre.

WEIGHT IN POUNDS AND OUNCES OF RAW WOOL CLIPPED BY THE STUD EWES WITH LAMBS AT CANTERBURY AGRICULTURAL COLLEGE, 1929 & 1930.

H. = Heaviest fleece. L. = lightest fleece. A. = the average fleece.

YEAR	ROMNEYS			CORRIEDALES			ENGLISH LEICESTERS			BORDER LEICESTERS			SOUTH DOWNS.		
	H	L	A	H	L	A	H	L	A	H	L	A	H	L	A
1929	16-8	7-0	12-1	13-10	7-4	10-15	14-0	6-7	10-11	13-10	5-4	9-6	6-14	3-6	5-6
1930	15-0	7-4	11-1	13-10	7-1	10-5	14-3	6-3	9-2	11-15	6-0	8-7	6-6	3-15	5-1

Combined with this genetical work there must be some careful feeding trials designed to determine the effect of various classes of foodstuffs, particularly those rich in and those lacking, sulphur, on wool production as regards both quantity and quality. Along with this work there is the necessity for an investigation of the effect of various mineral deficiencies on wool production, and the best method of solving the problems. In connection with this work, the staff of Canterbury Agricultural College already have outlined a scheme for measuring the effects of various types of top-dressing and pasture management on the total production - both mutton and wool of the sheep.

Earlier in this report mention was made of the fact that the amount of grease present in a fleece apparently exerted some controlling influence on the evenness or otherwise of the fibres produced, and the spinning properties of the wool. Preliminary work on this point already has been commenced at Massey Agricultural College; but the trouble appears to be how to obtain a correct measure of the effects brought about by the lack of yolk, normal quantities of yolk, and exeessive quantities of yolk in the fleece. It is also difficult to state how much of the trouble brought about by an insufficiency of yolk is due to lack of yolk secretion, and how much is due to washing out of the yolk by heavy rains.

STATISTICS AND ECONOMICS.

A study of the statistical figures with regard to wool soon will show how unreliable they are as a general rule, no two workers on the subject arriving at the same final figures. The work of Williams, of Massey College, confirms this statement; and that it is very difficult to arrive at any definite conclusion with regard to world production, demand, and present-day supplies is emphasised by statements being made with regard to the position as it is today. In England it is said thatit is not over-production that is the cause of the present record slump, that the stocks of raw wool, tops and yarns are not above normal, and that the industry is just buying sufficient to meet immediate requirements. American figures, however, show that there is excessive world production, and thatstocks on hand are higher than usual. Contrast this with the cotton market, where thebrokers and manufacturers can tell with fair exactitude the quantity of cotton on the market, and can give fairly reliable figures as to the production of the next crop. The wool brokers and manufacturers have no such well-organized scheme, any figures that are obtainable usually being compiled by individual firms or Associations, and no serious attempt being made at team work. There is no doubt that some scheme whereby it should be possible to accurately estimate the quantities of any one class of wool available for manufacture is one of the biggest needs of the wool industry at present.

With wool, the problem is more complicated than it is with cotton on account of the variations in the way wool is sold, being scoured, sliped or greasy, the wide diversity of countries producingwool and the almost continuous supply to the world's markets, the many varieties of wool produced, and the many hands through which they pass before the final material is sold as cloth, and the fluctuations in demand for the various classes. All of these facts make the preparation of accurate wool statistics a very difficult matter, and as is stressed by Dr. Henseler, International Review of Agriculture, Page 913, 1926, the first essential for the compilation of accurate statistics is an international scheme for the standardization of the grading and classifying of the various types and classes of wool. Until something is done along these lines so that figures are known for the world's supply of processed wool, such as tops and yarns of the various grades, and the stocks on hand and production of raw wool of each class on a clean-scoured basis, there mustbe a certain amount of confusion in the stastical figures for the industry. There is no doubt that in any scheme of Empire Wool Research the question of obtaining reliable statistical figures must play a prominent part.

There is in New Zealand a wide field for an economic survey into the question of methods of preparing the clip for marketing, and marketing methods. The question of the classing and sale of small clips is one requiring attention owing to the continual demand for more standardized sale lines, and the fact that the number of small clips will show a steady increase. Even in moderate-sized clips there is the question of whether a system of interlotting would not be a better proposition than the present method of selling a

number of lots, each with a few bales. This, of course, opens up the whole question of the classing of New Zealand wools, and in England the opinions on the matter seem to be rather varied. Top-makers who are making a wide range of tops, and, therefore, can make use of mixed lots, state that the present classing of New Zealand wools is satisfactory. Where, however, a limited range of tops is being made, especially where the scouring, preparing of tops, and spinning is all done in the one mill, the opinion is held that more care should be given to the classing. When all the buyers, both British and foreign, are considered, it probably would be better for more detailed classing to be carried out, provided some system such as interlotting could be introduced in order to overcome the difficulty of small lots. Some New Zealand clips at the present time could be improved by more careful skirting, and the paying of more attention to length as well as quality when classing.

With regard to the wool reclassed by New Zealand wool brokers there also is a certain amount of difference of opinion amongst wool buyers as to the evenness of the lines made up. The buyers naturally expect that this wool should be fairly true to name and the brokers are able to make a larger number of classes than is the farmer. However, there appears to be evidence of the fact that in many cases more care should be given to the work.

At the Conference at Bradford, with the British Wool Federation, the manufacturers made a strong appeal to the New Zealand producers to send more wool to the London sales in order to help the British manufacturer, especially those in a small way, to meet foreign competition, more particularly that from Japan. It was maintained that by so doing the Japanese would be forced to come to the London market, thereby having to pay double freight; It was argued that the competition would be as keen, if not keener, in London as in the Dominion, and that the producer would not be the loser. However, several other points were forgotten by the manufacturers, one being thatso long as the Japanese are able to obtain any wool in Australia or New Zealand, they will do so, and their competition on the New Zealand market must keep prices reasonably close to London parity. Another point is that sale in London means so many more handlings, etc., when foreign buyers purchase the wool, as compared with purchasing direct from the Dominions, and the increased handling charges ultimately must mean a loss to the producerand a gain to the English manufacturer.

In some quarters it is thought that it might be advisable to scour our wool in New Zealand so that transport costs might be lessened; but any good that might result from such a procedure would be offset in other directions. Every manufacturer has his own system of sorting; therefore, sorting the wool in New Zealand would not be practicable; and as the scoured wool would be more difficult to sort, it would not favour scouring here. During the scouring and drying processes, the wool can be quite easily damaged and scoured wool is more liable to damage during storage than is greasy wool; so, everything considered, it would not be advisable to introduce such a procedure.

Another problem that really is an economic one is whether or not it will be an economic proposition to try to breed and maintain a better-class-woolled sheep on the deteriorated class of land. The problem hinges partly round the questions of what prospects there are of bringing back to normal production, at mormal cost, this class of country, and what are likely to be the future market requirements and prices for wool and mutton. With the changes that have taken place in the wool and mutton markets in recent years, it is conceivable that on such country it may be betterto concentrate on fat lamb production and leave wool improvement alone. If lamb production is decided on, then it is a question if some breed other than the prevailing Romney type would not be more useful for the country.

With regard to wool prices, the general opinion amongst Bradford merchants seemed to be that although there was every likelihood of a rise in price in thenear future, yet it would be a few years before prices rose to the same level as those ruling in 1929. This, of course, is due partly to the world-wide depression, unemployment, and consequent lack of spending power of the general public, unrest, with unsettled conditions in India and China, and the low prices ruling for cotton, which always must have some influence on wool prices.

The slump in wool prices has been a severe blow to the production of substitute fibres; and even the shoddy and mungo markets are feeling the pinch. Artificial silk seems to have passed its zenith, and, if anything, the demand is on the decline. Admittedly it has displaced a large quantity of wool; but it has to be remembered that by the use toegther of artificial silk and wool, it has been possible to introduce new effects which have helped in the sale of some woollen goods. It also is thought that in the case of some articles, at any rate, there is now a swing back to wool in preference to artificial silk. What really is required nowis an artificial fibre, akin to wool in chemical and physical properties, and preferably made from wool, that can be more readily used for blending with natural wool. Work along these lines is being carried outat Torridon; but it would appear that there is a long way to go before it will be possible to economically produce such an artificial fibre containing any large quantity of wool.

The results of Dr. Weston's investigations(7) into the economics of wool production in Canterbury, show the necessity for a similar survey being made of the whole wool industry in New Zealand to ascertain if it is not possible to show the wool-producer where unnecessary leaks are occurring and where improvements might be effected.

CONFERENCES ATTENDED

A. CONFERENCE OF THE BRITISH WOOL FEDERATION AND SOME NEW ZEALAND WOOL GROWERS.

This Conference was held at Bradford, on 25th June, 1930, and was presided over by Mr. George Whitaker, President of the Federation. Mr.Bernard Tripp, of New Zealand, spoke about the proposals for a wool levy in NewZealand in order to raise funds for an advertising scheme to boost the sale of woollen goods and to assist in further improvement of wool. Mr. Tripp was given a very good hearing by the manufacturers, who thought the idea a very good one, but who stated that they could not promise very much support from the manufacturing community, who already spent large sums in advertising. The general opinion in Bradford seemed to be that while advertising was a good means of helping the sale of any goods, the time was not opportune for launching a big wool advertising scheme at present. The reasons given for this were that the world-wide depression was limiting the public purchasing power, and that it might be betterto wait and see if it were possible to improve some of the present objectionable features of woollen garments.

The next business was a paper by Sir Frederic Ayckroyd on the manufacturing uses and the defects of New Zealand wools. This gave the wool-growers present a very good idea of the requirements of some of the manufacturers; and the discussion that followed gave the manufacturers an idea of the difficulties and the problems the wool-producer has to face, and how it is not always possible to produce the type of wool the manufacturer requires. In fact, the discussion was so prolonged that there was only a limited time left for hearing papers by Mr. H. Hull on "WOOL MARKETING", and by Dr. Barker on "SHEEP-BRANDING FLUIDS". The former stressed the necessity from the buyer's point of view of having fewer selling centres and better arranged sale dates. The latter paper pointed out the benefits to be derived from the use of a sheep-marking fluid that would scour out, if not in an ordinary scouring liquor, then in a special piece scour.

During the discussion on Sir Frederic Ayckroyd's paper, it was pointed out by some New Zealanders present that while a general complaint was made in regard to New Zealand wools, the individual producer did not know whether or not his wool was good or bad. It was suggested that if the manufacturer who received any lot of wool were to let the grower of the wool have a report on it, such a procedure would assist in wool improvement. After the conference I wrote to the Secretary of the British Wool Federation, asking if the latterwould support a scheme for supplying the wool-grower with forms that he could enclose in his bales of wool, asking for the buyer's opinion of the wool. The Committee of the Federation, however, decided that they would not support such a scheme. I still am ofthe opinion, however, that some scheme along these lines should help the individual producer to know where his wool is at fault, and what features require improvement. Appendix V1. is an idea of a form to be enclosed in one bale of each lot sold by the grower, and to

be filled in by the buyer and returned to the grower.

The Conference served a very useful purpose in bringing together representatives of both theproducers and users of such an important article of commerce as wool. If such conferences could be held in the producing countries it would do much to help wool improvement and at the same time would show the limitations of the wool-grower.

B. IMPERIAL WOOL RESEARCH CONFERENCE, 1930.

The Proceedings of, and the Papers read at, this Conference have been reported in detail in the official report issued by the Empire Marketing Board. The Conference served a useful purpose in bringing together those interested in wool improvement in the British Empire, and so assisting in promoting personal contact. The benefits to be derived from such a Conference, however, might have been considerably improved if more time had been given to round table discussions with representatives of the manufacturers and the leading research workers. This would have resulted in a better understanding of the manufacturers' requirements and demands, and a discussion of how best the producer could improve his wool to meet such demands. As an example of the need for such a discussion, there was some talk at the Conference about closer co-operation between the manufacturer and the producer, yet little was done to place this most important aspect of wool improvement on the really sound basis that is necessary if the best use is to be made of any wool improvement scheme. As it was, part ofthe time was devoted to listening to long reports, a good deal of the contents ofwhich, through the medium of official reports, already were known to the majority of those attending the Conference.

SUMMARY

In any scheme for wool improvement one ofthe first necessities is to know what are the faults ofthe wools being produced, how far it is possible for the producer to correct such faults, and whether or not it will be an economic propowition to effect such improvements. The chief faults complained of in present-day New Zealand wools have been outlined in some detail in this report, and means of correcting them have been discussed. It may be well here to emphasise a few facts that are of the utmost importance to New Zealand producers.

(a) That little or nothing is known of the inheritance of some of the irregularities in New Zealand wools; (b) That if theproducer succeeds in breeding out these defects, will his wool still be as useful a protective agent as it is at presnet, and will it stand up to rough wear?: (c) That in any scheme of wool improvement thecarcase must not be overlooked; (d) That before any marked change in type of wool is considered, more statistical information is required, and a knowledge of what is likely to be the trend of fashion for the next few years, so that there may be no serious unbalancing of supply and demand.

The close co-operation ofthemanufacturer also is a prime necessity if our wool is to be improved to meet manufacturing demands. While those engaged at the manufacturing and certainly have been very free with their advice to the producer, and their criticism has done a good deal to help in wool improvement, some of it has been misdirected, and even contradictory; and little notice has been taken of whetheror not it is possible for the producer to put into practice the manufacturer's demands. What really is required is for the producer to grow that class of wool that will give him the best economic return, and for the manufacturer to make the best use he can of this class of wool. As Professor Crew points out(6) all of the propaganda relating to wool improvement comes from the manufacturer; and the sole value of propaganda is that it benefits the propagandist.

While it still is possible forthe breeder, by careful selection and better breeding methods, to improve his wool, it has to be remembered that without correct feeding it will not be possible for the sheep to produce the maximum quantity of the best class of wool. Thus, in any scheme of wool improvement in New Zealand the first essentials are to attend to the producer's breeding and feeding methods. The former should aim at producing the maximum

quantity of good quality wool, while the latter should be such that the sheep have a regular supply of foodstuffs that meet the requirements of the animal for all its bodily functions. At the same time it is necessary for the producer to control disease and parasites in his stock, since these may well affect the quantity and quality of his wool.

The most immediate steps that can be taken by the New Zealand sheepfarmer to improve his wool clip are those of seeing that his sheep receive a regular supply of sufficient food to meet their immediate requirements, and when buying rams or ewes to endeavour to procure those sheep that combine to the greatest extent quality and quantity of wool with a sound constitution and good carcase. The stud breeder, by careful selection, has to endeavour to reduce to a munimum the quantity of medullated fibre in the wool from his sheep, to improve the handle of his wool, and, by a system of wool-weighing to breed from those strains within his flock producing the heaviest fleeces compatible with quality. Some of the research work requiring to be carried out in NewZealand is -

1. A careful study of the inheritance of undesirable fibres in all breeds.

2. A careful study of the inheritance of weight of wool produced.

3. A careful study of the effects of feeding on wool production, both quantity and quality.

4. The determination of the effects of excess and deficiency of yolk in the wool fibres.

5. Assisting in the endeavours to produce improved woolpacks and branding fluids.

6. An economic survey into wool production in New Zealand.

In conclusion I desire to most hearily thank the Board of Governors and the Director of Canterbury Agricultural College for granting me a year's leave of absence; Dr. E. Marsden and Mr. N.L. Wright, of the Department of Scientificaand Industrial Research, for making the necessary arrangements for the trip; Mr. King and Mr. Hildred, of the Empire Marketing Board for their kind attention while in England; and the Directors and the various members of the staffs of The Wool Industries Research Association; the Animal Breeding Research Department; The Rowell Research Institute and the Department of Agriculture, Cambridge University, for the many kindnesses and hospitality extended to me during my visits to their institutions. All have assisted in making the trip both instructive and interesting from every point of view.

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APPENDICES.

No. I. Report on New Zealand fleeces by Sir Frederic Aykroyd, 6th May, 1930.

No.II. " " " " " " " " " , June, 1930.

No.III. "SOME RESULTS OF CROSS-SECTIONAL AREA AND CONTOUR MEASUREMENTS OF NEW ZEALAND ROMNEY AND CORRIEDALE WOOLS." Journal Textile Institute Reprint. D. J. Sidey

NO.IV. "THE SULPHUR CONTENT OF SOME NEW ZEALAND WOOLS". D. J. Sidey.

No. V. "NEW ZEALAND WOOLS. THEIR EXCELLENCIES AND DEFICIENCIES". Report No.1 by British Wool Federation.

No.VI. Suggested form for wool-buyer to report on each individual clip.

No.VII. Manufacturing Tests.

APPENDIX 1.

SIR FREDERIC AYKROYD'S COMMENTS:

Tag 1. Romney Ewe: Fairly even in staple, regular as regards fineness. No complaint to make with the wool at all.

Tag 2: Romney Marsh: Pretty well the same as 1. A good hosiery wool. Very much drier than 1, but not to be condemned on that account. A shade harder than 1.

Tag 3: Lincoln-Romney: First Cross. Wool is rather short for its quality (36's), but not a bad fleece. Begins to show irregularity of fineness, being first cross,

Sir Fredric was of opinion that these were not typical Romney wools as sent to this country.

A SERIES: (All wool is hoggets' wool, except where otherwise mentioned).

1A. Lovely wool. One of the best of the samples. Beautifully even.

2A. Wonderfully even in fineness. Nothing wrong.

3A. Nothing wrong.

4A. Not quite so good. Not quite up to the standard of the rest of the A series. Stronger fibres present. Not so regular, but not really bad.

5A. Nothing wrong.

6A. Very good.

7A. Lovely wool.

8A. Wether (2nd. year) Fibres irregular in fineness.

9A. Quite nice wool. Just a little irregularity, but still high-class wool.

10A. A shade harder and a shade more irregular than most of the series. Not quite so good.

12A. Very nice wool. Beautiful handle.

14A. A good fleece.

15A. Lovely wool.

16A. Good wool. Nothing to which to take exception.

17A. Nothing wrong. Lovely wool. Beautiful handle.

18A. Good wool, but few irregular fibres. Not quite so good.

19A. Lovely wool. Wonderfully even. No fault to be found at all.

20A. Very well-bred wool. Very even. Nothing wrong.

21A. Beautiful young wool.

24A. Beautiful wool.

25A. Nothing wrong.

26A. High-class wool.

27A. Beautiful wool.

B SERIES: (All wool is hoggets' wool except where otherwise stated.).

1B. Slightly irregular in fineness.

2B. Irregularity just showing slightly. Wool described as getting "hungry".

3B. Deterioration as regards irregularity, i.e., presence of coarse fibres just beginning to show itself.

5B. Deteriorated in regularity but deterioration not pronounced because it is hogget's wool.

6B. Same as 5B.

7B. Not at all bad.

4B. Beautiful fleece. Deterioration just visible.

8B. Good 60's: very nice wool.

9B. Nothing wrong.

10B. Just showing deterioration.

12B. No serious objection.

14B. Deterioration just beginning to show itself. Not bad.

16B. Deterioration just slight.

17B. Just slightly irregular. Not pronounced - just on the turn. Anyone would like it as a hosiery wool.

18B. Irregularity in thickness noticeable immediately. Deteriorated considerably from Class A. Harder.

19B. As good as A class.

20B. Nothing wrong.

21B. Nice wool. Irregularity just showing very very slightly.

24B. Hard, shiny hairs. One of the worst. Deterioration set in but still passable.

25B. Not so bad as 24B, but lower quality, therefore, irregularity not so apparent.

26B. Only slight deterioration.

Sir Frederic Aykroyd's general impression was that there was a deterioration in the B class due to the presence of irregular fibres; but this deterioration was not serious so long as it stayed there. The irregularity, perhaps, was more a tendency than a reality.

C. SERIES. (All wool is hoggets' wool except where otherwise stated.).

2C. (48's) moderately even: not bad.

3C. Nice hosiery.

6C. Almost in B class. Ewe not so good, therefore, not so much deterioration.

7C. Very nice fleece. The least shade of coarse hairs showing. Nothing seriously wrong.

8C. Beautiful fleece, wonderfully even, no fault.

10C. Quite nice fleece. Nothing wrong.

12C. Nothing wrong. Nice hosiery fleece. Fairly even in breed. (50's to 56's).

16C. Bad britch. Deterioration setting in. Effect of Romney shows itself, and to continue crossing would soon ruin the wool.

17C. Tender, but purely a question of feed. Nicely bred fleece.

18C. Lovely young wool. Beautiful fleece.

19C. Nothing wrong. Just teggy or hoggety. Quite nicely even.

20C. Nothing materially wrong. Fairly even.

21C. Beautiful wool but deterioration has set in. (Good ewe crossed with Romney).

24C. A bit tender at the bottom (lack of water in early summer). Deterioration has certainly set in. The wool spoilt by ram. The ewe has had splendid wool. Ought to show really nice wool. Would certainly complain about this.

25C. Nothing materially wrong. Good hosiery wool.

26C. Shows bad breeding. Irregularity in some staples. Falling off in fineness between tip and middle and middle and root.

27C. Beautiful fleece. Bit long for quality, 56's quality and 50's length.

D SERIES. (All wool is hogget's wool except where otherwise mentioned).

6D. Very round in hair. Hosiery wool. Pretty even quality. Very open.

7D. Nothing to which to take exception. Not quite so uniform as the rest perhaps.

8D. Quite a nice fleece.

18D. Beautiful hosiery wool. Lovely young wool.

19D. Quite a nice hosiery wool. Pretty even.

25D. Nothing seriously wrong.

I consider the fleeces as whole as representing a very good type of wool. They are not by any means the class of wool that has been complained of, and, speaking as a wool-buyer, I should say are far above the average of the cross-bred wool grown in New Zealand.

(Sgd.) FREDERIC A. AYKROYD.

6th May, 1930.

KEY TO FLEECE NUMBERS.

CORRIEDALE.

1. Canterbury Agricultural College, Lincoln.
3. D. Sidey , Hawarden.
4. C. and T. Anderson, Hawarden.
5. J. K. Forrester, Hawarden.
6. G. T. Evans, Hawarden.
7. S. B. Gibb, Motunau.
8. F. H. Courage, Amberley.
9. H. Ensor, Rakahakuri, Rangiora.
10. A.A.Mackintosh, White Rock, Rangiora.
12. J. Reid, Darfield.
14. C.H.S. Johnston, St. Andrews.
17. W. H. Orbell, The Levels.
18. Hayland Estate, Rangiora.
19. E. and J.W.Ensor, Rydal Downs, Rangiora.
20. G. A. BLAND, Mount Somers.
21. H. P. McIntyre, Gore-Waikaka Rural Delivery.
25. D. J. Ross, Hillgrove.
26. New Zealand Land Company, Moeraki.
27. Norman Hayes, Hakataramea.

ROMNEY.

2. Canterbury Agricultural College, Lincoln.
15. C.H.S.Johnston, St.Andrews.
16. W.H.Orbell, The Levels.
22. J.P.Thayer, Gore-Maitland Rural Delivery.
24. Alex. Holmes, Waimahaka.

Tags 1 and 11 from Mr. W.Perry.

Tag 111 obtained by Mr. W.Perry.

APPENDIX 11.

EXAMINATION OF NEW ZEALAND FLEECES. BY SIR FREDERIC AYKROYD, JUNE, 1930.

Lot.	QUALITY (Count)	Length.	Handling.	Appearance.	Strength.	Evenness of fleece.	Evenness of fibre.	GENERAL REMARKS.
A1.	46's	Rather short.	A little harsh.	Good yield.	Quite sound.	Does not run off at britch or neck.	Varies in quality along length.	Fup. Too many strong hairs. Up to a point good hosiery wool.
A2.	48's	Rather short.	Softer.	-	Quite sound.	Britch not too bad.	Rather irregular.	A lot of shiny hairs.
A3.	48's prepared.	Good.	Beautiful soft handle.	Good.	Sound.	Good.	-	Very nice wool.
A4.	48's-50's	Stumpy.	Slightly harsh.	Dull (demi).	Quite sound.	Fairly good.	-	Shade harder, not good spinning wool.
B1.	48's prepared.	Rather short. Better 1" longer.	Shade harder than it should be.	Good.	Quite sound.	-	Slightly irregular.	Good spinning wool.
B2.	48's prepared.	Ideal length.	Good.	Good.	Quite sound.	Britch not too bad.	Fairly even.	Nice fleece of wool.
B3.	48's prepared.	Good length Some a little on the short side.	Quite good.	Good.	Good.	-	Even in staple.	-
B4.	46's prepared.	A little stumpy.	Not quite at its best: slightly harsh.	Good on the whole. Slightly weather-stained.	Quite sound.	-	Slightly irregular in staple.	Too many irregular hairs.

EXAMINATION OF NEW ZEALAND FLEECES (Continued).

LOT.	QUALITY (Count)	LENGTH.	HANDLING.	APPEARANCE.	STRENGTH.	EVENNESS OF FLEECE.	EVENNESS OF FIBRES.	GENERAL REMARKS.
B5	46's prepared.	A little on the short side.	Not bad for quality.	Good.	Quite sound.	-	-	Few strong hairs.
C1.	36's	Too short.	Quite good for quality.	Good.	Quite sound.	All right.	Quite good.	-
C2.	48's carded. Some prepared.	Bit deficient for quality.	All right.	Good.	Good.	Fairly even.	A few bright hairs.	-
C3.	48's carded	Good.	Very harsh.	Dull.	All right.	Fairly good. Britch bad.	Too many bright shiny hairs.	-
C4.	48's-50's	All right.	Mixture of hard and soft.	Moderate.	Quite sound.	Irregular.	Irregular.	Lot of strong hairs.
D1.	46's prepared.	All right.	Hard.	Poor colour owing to wrapping up damp.	Sound.	All right.	Irregular.	Too round in the fibre.
D2.	50's prepared.	Good.	Slightly harsh.	Good.	Good.	Good.	Very slightly irregular.	Hogget better fleece.
D3.	50's-48's prepared.	Good.	Harder than it should be.	Good.	Good.	Good.	Not quite as regular.	Too round in the hair: lacking foodiness.
D4.	48's-50's	Rather deficient in length.	Rather hard.	All right.	Sound.	All right.	Few shiny hairs.	Too round. Hogget.
D5.	48's-50's.	Good.	Rather better.	Good.	Sound.	All right.	Not bad. Quite fair.	Hogget.

EXAMINATION OF NEW ZEALAND FLEECES (Continued).

LOT.	Quality (Count)	LENGTH.	HANDLING.	APPEARANCE.	STRENGTH.	EVENNESS OF FLEECE.	EVENNESS OF FIBRES.	GENERAL REMARKS.
D6.	48's-50's prepared.	Good.	Very slightly harsh.	Good.	Sound.	-	-	Nearly the same as the last.
Cross-bred unknown 1.	48's-46's prepared.	Good.	Hard.	Dull.	Quite sound. Some slightly tender.	Moderate.	Very uneven.	Ram's wool.
Ex Matahiwi Wairarapa clip	48's	All right.	Slightly hard.	Good, but going backward.	Sound.	All right.	Irregular.	Was good, but getting ruined by crossing.
Feilding district 1.	48's carded.	Carded quality	Slightly hard.	Good.	Quite sound.	Fairly regular.	Irregular.	Good wool, spoilt by crossing.
Wanganui district 1.	48's-50's.	Good.	Slightly hard.	All right.	Quite sound.	All right.	Irregular.	-
" " 2.	48's carded.	All right.	Quite good.	good.	Tender.	Good.	All right.	Nice bred fleece.
H.M.S. Hogget.	46's prepared.	Good.	Slightly harsh.	Good.	Sound.	-	Slightly irregular.	Ice round in the hair. Good ewe spoilt with bad ram.
H.M.S. Ewe.	50's.	Would be good but a bit tender.	Not as soft as it should be. Slightly harsh.	Wrapped up damp.	Tender.	Fairly good.	Slightly irregular.	Slightly weather-stained.
Feilding district. 2.	48's prepared.	Good.	Slightly harsh.	Good.	Sound.	Quite all right.	Slightly irregular.	-

EXAMINATION OF NEW ZEALAND FLEECES. (Continued).

LOT.	QUANTITY (Count)	LENGTH.	HANDLING.	APPEARANCE.	STRENGTH.	EVENNESS OF FLEECE.	EVENNESS OF FIBRES.	GENERAL REMARKS.
Tawera.	48's prepared.	Shade on the short side for quality.	Good.	Good.	Rather on tender side.	Fairly good.	Irregular.	Good wool spoilt with breeding.
Feilding 3.	50's prepared.	Quite all right.	Slightly harsh.	Good. Wrapped up damp.	Quite all right.	all right.	Few bright hairs.	-
Unknown 2.	50's prepared.	Good.	Rather hard for quality.	Good.	Sound.	Good.	Slightly irregular.	-

N.B. Lots A, B, C, and D, were from Stud Romney flocks.
Those with a name are cross-bred wools selected in Levin's Wool Store, Wellington.

KEY TO LOTS.

LOT A. Blair and Hunter, Wanganui.

B. G.F.Short,Esq.,Feilding.

C. N.P.Neilson,Esq.,Karere,Manawatu.

D. Q. Donald, Esq., Featherston.

APPENDIX 111.

SOME RESULTS OF CROSS-SECTIONAL AREA AND CONTOUR MEASUREMENTS OF NEW ZEALAND ROMNEY AND CORRIEDALE WOOLS.

By

D. J. SIDEY, B.Ag.,H.D.D.

(Wool Industries Research Association).

The Wool Research Committee of the New Zealand Council of Scientific and Industrial Research, acting in co-operation with the Wool Industries Research Association, decided that in connection with wool research in New Zealand a collection of representative Corriedale and Romney fleeces should be sent to Torridon, for both trade opinion and laboratory examination.

The Romney fleeces were collected in both the North and the South Island, and the Corriedale fleeces from the South Island. A total of 110 fleeces were submitted. In the case of the North Island fleeces, the breeder is designated by a LETTER in the accompanying tables, and the various fleeces by a NUMBER, while in the case of the South Island wools a NUMBER has been used for the breeder and a LETTER for the fleeces. It should be noted here that whereas the North Island fleeces were selected for evenness, the South Island fleeces were selected to show the different types of wool present in the various flocks.

It was decided that the first test should be of a commercial character, and a trade opinion was obtained on each fleece. The commercial report on these fleeces stated that the majority were very good, a few were only fair, and that taking the fleeces as a whole they represented a class above the standard of the average New Zealand cross-bred wool. This examination enabled the fleeces to be divided into three groups -

GROUP I. - Very good according to trade opinion.

GROUP 11- Medium " " " "

GROUP 111 - Fair " " " "

and representative fleeces were selected from each group. From each selected fleece a moderate size shoulder sample was taken for the purpose of the laboratory examination. For purposes of measurement as detailed in the accompanying tables, this main sample was subdivided into sixteen zones by successive division, and from each zone a small lock of wool was selected. From these small locks approximately even bundles of fibres were carefully separated off and were grouped together according to the number of sections it was necessary to cut. The resulting composite bundles were washed in ether to remove grease and dirt, and were then gently combed to straighten the fibres prior to imbedding in collodion and paraffin wax by the method described by Barker and Burgess[1]. The section-cutting and measurement of the fibres was also carried out as described in that publication, and the results obtained were treated statistically by the method outlined by Fisher.[2] The coefficient of variation was determined by the use of the formula -

$$\text{Coefficient of variation} = \frac{\text{Standard Deviation} \times 100.}{\text{Mean cross-sectional area}}$$

(See Tables).

TABLE 1 - ROMNEY FLEECES.

GROUP.	No.	Mean-Cross-Sectional-6 area x 10 sq.cm.	Standard error. ±	Co-efficient of variation.	Smallest cross-sectional area.	Greatest cross-sectional area.	% fibres < ½ mean cross-sectional area.	% fibres > 3/2 mean cross-sectional area.	Contour A/B	% fibres < 1.10 A/B	% fibres > 1.40 A/B	Greatest A/B	Mean A/B for Group.
1.	22A	9.703	0.229	37.9%	2.40	17.86	7.3	8.4	1.220	23.1	11.9	1.65	
	24A	7.390	0.171	40.2%	1.95	15.50	11.7	11.7	1.155	35.7	3.0	1.60	
	A3	9.170	0.154	29.2%	2.40	16.77	5.3	4.0	1.132	43.1	1.7	1.70	
	B2	11.090	0.201	31.4%	1.82	23.03	6.3	5.0	1.155	39.3	4.3	1.57	1.157
	C1	16.387	0.343	36.3%	3.40	27.70	13.7	5.0	1.098	57.7	0.7	1.59	± 0.017
	Tag1	10.479	0.195	31.0%	3.4	20.25	4.3	7.2	1.185	30.4	9.3	1.85	
11.	2B	7.756	0.219	49.8%	1.56	17.0	12.0	12.3	1.225	21.6	15.2	1.80	
	2C	7.128	0.172	41.3%	2.10	24.84	8.9	9.2	1.219	30.0	8.9	1.75	
	16B	12.604	0.245	33.8%	2.25	24.48	4.4	6.1	1.275	10.1	29.4	2.00	1.210
	D4	11.600	0.246	36.7%	2.89	25.01	7.0	10.7	1.207	25.0	8.0	1.66	± 0.018
	Tag2	7.460	0.186	45.0%	1.80	16.80	16.0	9.8	1.203	27.4	10.1	1.75	
	A1.	10.427	0.203	33.8%	3.61	22.00	5.6	9.6	1.142	40.0	2.8	1.67	
111.	16C.	10.743	0.210	33.5%	3.40	23.65	3.4	5.1	1.203	23.2	8.2	1.75	
	24B.	8.477	0.224	45.6%	2.40	23.37	14.7	13.3	1.246	15.0	17.7	1.75	1.245
	24C.	11.397	0.265	29.6	1.69	20.80	9.6	8.5	1.287	17.4	24.4	1.90	± 0.024
Average for all Groups.				37%					1.197				

Group 1 = Very good according to trade opinion.
Group 11 = Medium " " " "
Group 111 = Fair " " " "

TABLE 11 - CORRIEDALE FLEECES.

Group	No.	Mean cross-sectional area x 10^{-6} sq.cm.	Standard Error.	Co-efficient of variation	Smallest cross-sectional area.	Greatest cross-sectional area.	% fibres < ½ mean cross-sectional area.	% fibres > 1½ mean cross-sectional area.	Contour A/B	% fibres <1.10 A/B	% fibres >1.40 A/B	Greatest A/B	Mean A/B.
1.	6A	6.006	0.138	35.8%	2.38	13.95	2.6	9.8	1.213	19.7	7.8	1.61	
	17A	5.638	0.156	43.6%	1.82	18.00	7.6	12.4	1.176	30.4	5.6	1.69	1.199
	18C	5.554	0.124	33.4%	2.72	12.09	1.8	11.1	1.196	23.6	7.1	1.63	
	26A	5.914	0.153	40.7%	1.68	15.40	8.5	12.1	1.219	20.2	10.1	1.59	±0.008
	27C	5.956	0.122	32.5%	2.40	14.06	1.6	12.4	1.192	23.2	6.0	1.61	
11	4A	7.494	0.149	29.7%	2.55	15.40	3.3	7.6	1.223	15.6	7.6	1.73	
	7B	6.286	0.103	25.7%	2.72	11.10	3.6	4.4	1.228	20.4	10.8	1.57	
	9A	5.364	0.156	42.2%	2.08	15.48	2.8	10.4	1.182	26.0	3.6	1.64	1.201
	19C	6.495	0.159	34.4%	2.85	13.60	8.6	13.6	1.218	23.2	10.1	1.82	±0.012
	21C	5.312	0.133	39.6%	2.24	15.48	8.4	12.4	1.201	17.6	5.2	1.53	
	8A	5.986	0.159	42.4%	2.10	13.26	10.0	11.6	1.152	32.4	2.4	1.62	
111	18A	7.476	0.196	38.9%	3.00	16.17	4.8	14.3	1.273	15.2	22.9	1.72	
	18B	5.982	0.107	39.9%	1.95	14.96	5.6	11.2	1.238	19.2	12.8	1.61	1.224
	25B	8.340	0.181	34.4%	2.88	16.80	6.8	10.0	1.151	33.6	4.0	1.60	±0.026
	26C	7.180	0.205	44.6%	2.08	24.96	7.2	10.4	1.234	15.2	14.4	1.62	
Average for all groups.				37.3%					1.206				

Group 1 = Very good according to trade opinion.
Group 11 = Medium " " " "
Group 111 = Fair " " " "

DISCUSSION OF RESULTS.

In the abovetables the results are arranged according to the grouping of the fleeces previously noted; amd it will be observed that there is little relationship between the trade classification of the fleeces and the coefficient of variation of cross-sectional area or fineness in either the case of the Romney or the Corriedale. It also should be noted that in the case of the Romney wools there are in most cases approximately equal percentages of fibres outside the limits of one-half and one-and-a-half times the mean cross-sectional area. In the case of the Corriedale wools, however, there is adistinct tendency towards a greater percentage of coarser than finer fibres outside thes This probably results from the present-day tendency of the Corriedale breeder to select towards a class of wool more nearly approaching the Merino rather than the Lincoln or the Leicester.

In the case of the figures for Contour, it will be noticed that there is a close relationship between the trade conception of a good wool and the average contour or ellipticity figure for each group. This i particularly noticeable in the case of the Romney, the average figures for Contour of each group being :-

	Romney.	Corriedale.
Group 1 - Very good according to Trade opinion ..	1.157	1.199.
" 11.- Medium " " " " ..	1.210	1.201.
" 111.- Fair " " " " ..	1.245	1.224.

These figures are in accordance with the opinion expressed by Barker and Burgess [1] that contour probably plays an important part in the spinning properties of a wool.

Probably one of the most pleasing features in this examination from the point of view of the New Zealand wool-producer is that although some of the Romney and Corriedale wools show marked irregularity of size and shape of the fibres, others show a fairly high degree of regularity. It is evident, therefore, that by a careful selection within the breeds for fibre regularity, made possible by modern research methods, it should be possible to improve existing flocks to produce a type of wool that would be most acceptable to the manufacturer. In the above tables, however, the average coefficients of variation and the average contour figures for fifteen stud Romney and fifteen stud Corriedale fleeces show practically equal figures. This would indicate that the Romney wool from some of the best stud flocks is moderately even, and that therefore there should be every possibility of improving the crossbred wool by using well-bred rams. It should be remembered that the wools examined in this case were stud wools. Manufacturers have based their criticisms mainly on the crossbred wools from New Zealand; and one of the reasons why the Romne crossbred wool has been condemned is because of the tendency this bree has to produce medullated fibres when badly bred. Although the cross-sectional photomicrographs taken in connection with this work showed a greater proportion of medullated fibres in the case of the Romney than in the case of the Corriedale, it would be extremely difficult to express the presence of these detrimental fibres as a percentage, since it is difficult to say how much medulla must be present to be harmful. In this connection it might be pointed out that one of the Romney wools that appeared to be free from medulla when examined with the naked eye showed a fair proportion of fibres with a very fine medulla. It would seem, therefore, that when more attention is paid to the careful selection of stud Romneys, with the greatest uniformity of wool characteristics and an absence of medullated fibres, that a desirable type of wool will be produced.

It might also be pointed out here that in many of the cases where the trade opinion of the fleeces noted a particularly soft handle, it was subsequently found that the wool had a low contour figure, i.e., more nearly approaching the circular. Although the contour or ellipticity of the wool fibres is not the only factor that plays a par in the handle of a wool, it probably has a considerable influence on this factor.

Photomicrographs A and B, respectively, illustrate moderately even and regular Romney and Corriedale wools, while C and D, respectively, illustrate bad cases of irregularity in the Romney and the Corriedale.

The author is greatly indebted to the Council of the Wool Industries Research Association for permitting the work to be done in the laboratories at Torridon; to Dr. S. G. Barker, Director of Research, for helpful advice; and to Mr. C. G. Winson and Miss A.L.Walker, without whose valuable assistance it would not have been possible to carry out the work.

REFERENCES.

1. S. G. Barker and R.Burgess. "Some Characteristics of Wool as Affecting Worsted Spinning." Pub. 87 of the W.I.R.A.

2. R.A. Fisher. "Statistical Methods for Research Workers". 1928.p.48.

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APPENDIX 1V.

THE SULPHUR CONTENT OF SOME NEW ZEALAND WOOLS:

In a Paper (Appendix 111.) the author described the collection of the New Zealand fleeces sent to Torridon for a trade report and laboratory examination. For the purpose of determining the sulphur content of some of these wools, pairs of fleeces were selected from some of the lots so that each pair were from sheep of the same age and sex having received similar treatment. With the exception of the two lots numbered 18, which came from the same flock, the different pairs came from flocks in different parts of New Zealand having different soil and climatic conditions. According to the trade opinion obtained, one fleece of each pair was a good spinning wool and the other not so good.

The same shoulder samples were used in these experiments as were used in the experiments described in the previous paper (Appendix 111), and the sub-samples required for the analyses were obtained by taking random staples from each of the sixteen zones into which the main sample was subdivided. The sub-samples were thoroughly cleansed by two washings in hot benzene, one washing in a 0.1% Saponin solution and several changes of distilled water. The wool, after drying, was combed on two hand cards to permit of better conditioning and sampling, and was left in a room kept at a fairly constant humidity for at least 24 hours. Samples were then taken for moisture determination by the method described by Barrit and King(1), and for sulphur content by the method described by Rimington(2). The results of the analyses are shown in the accompanying table. Each result is the average of three or more determinations on the one sample, and the Standard Error of the results is given.

(See Table).

It will be seen from the Table that, in every case except one, the better spinning wool of each pair has a higher sulphur content than the lower class wool, and that in the case of the exception there is no significant difference. For each pair of fleeces the sulphur content also is in inverse proportion to the coefficient of variation and the Contour figure, i.e., the wool that by laboratory analyses theoretically should be the better spinning wool has the higher sulphur content. It would appear, therefore, that there is some correlation between the spinning properties and the sulphur content of a wool. Admittedly, there are not many analyses in this set; so a good deal more work will be necessary before any definite statement can be made.

(NOTE: A fuller account will be available when the reprints of the published article are available.).

References: (1) "THE SULPHUR CONTENT OF WOOL" by Barrit and King. Publication No. 62. Wool Industries Research Association.

(2) "A METHOD FOR THE DETERMINATION OF SULPHUR IN WOOL AND SIMILAR MATERIALS." by C.Rimington. Publication 125. Wool Industries Research Association.

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TABLE TO APPENDIX IV.

GOOD WOOLS ACCORDING TO TRADE OPINION.					FAIR WOOLS ACCORDING TO TRADE OPINION.				
SAMPLE.	Description.	Sulphur %	Co-efficient of variation.	Contour A/B ratios.	SAMPLE.	Description.	Sulphur %	Coefficient of variation.	Contour A/B ratios.
Tag.1.	Romney ewe.	3.16% ± 0.026.	31.0%	1.185.	Tag 11.	Romney ewe.	3.06% ± 0.029.	45.07	1.203.
24 A.	Romney Hogget.	3.17% ± 0.033.	40.2%	1.155.	24 B.	Romney Hogget.	2.97% ± 0.029.	45.6%	1.246.
26 A.	Corriedale Hogget.	3.21% ± 0.032.	40.7%	1.219.	26 C.	Corriedale Hogget.	3.11% ± 0.015	44.5	1.234.
18 C.	Corriedale Hogget.	3.02% ± 0.009	33.4%	1.196	18 B	Corriedale Hogget.	3.04% ± 0.007	39.9%	1.238
18 D.	Corriedale Hogget.	3.18% ± 0.012	Not determined.	Not determined.	18 A.	Corriedale Hogget.	3.07% ± 0.018.	38.9%	1.273.

APPENDIX V.

NEW ZEALAND WOOLS.

THEIR EXCELLENCIES AND DEFICIENCIES. (From British Wool Federation.)

There have been very important changes in New Zealand wools during the past thirty to thirty-five years. It was in the early seventies that New Zealand pastoralists began to convert their merino flocks from merinos into crossbreds. About 1870-72 there were 98 per cent. of merinos and only 2 per cent. of crossbreds being pastured in the Dominion, whereas to-day there are 98 per cent. of crossbreds and only 2 per cent of merinos. This at once shows the great change that has come over the character and quality of the wools grown.

It is not necessary to go into detail regarding the immense difference there is in the wools being marketed to-day as compared with former years. The question arises as to what are the outstanding characteristics seen in New Zealand wools, and especially what are their deficiencies.

Important changes have come over a sheep man's life in New Zealand since 1914 - probably the result of fashion and experience in New Zealand pastoral circles. In the great conversion period when New Zealand pastoralists went in for breeding sheep fit for the freezing establishments, Lincoln and Leicester rams were extensively used. They were the pioneer sheep in the conversion process; but in the course of time there arose a call for smaller mutton sheep among the wholesale distributors in Smithfield; consequently, to a very large extent, the Lincoln and Leicester sires have been discarded, and there has been a very big change both in the character of the sheep and in the quality of the wool.

The very fact of there being to-day such a great diminution in the supply of coarse crossbred wool in New Zealand, confirms the above observations. The supply of 36's to 40's preparing wool has dropped off by at least 50 per cent. since 1914, with a corresponding large increase in the supply of medium crossbreds, say 46's to 50's, and a slight increase in prepared qualities 44's, 46's, and 50's. This is all due to the extensive employment of the Romney as the sire, which in the course of two or three crosses means that even the ewe flock will be chiefly of a Romney character. According to New Zealand pastoralists the Romney produces the most acceptable sheep for freezing purposes, and up to two or three seasons ago when good paying prices were forthcoming for medium quality wool, there was evidence that the Romney was going to remain the most popular sheep, no matter what objections Bradford raised to the depreciation in the fleeces shorn.

Wool users consider that the greatest deficiency to-day in New Zealand crossbreds is the lack of uniformity in quality. Sufficient care has not been taken in the past in the purchase of Romney rams and ewes growing a more uniform fleece of wool. Every practical wool man knows that the quality of the fleece of the Romney falls off very much at the rump, and still more at the britch. Moreover, there is a tendency for other parts of the fleece to deteriorate in the same way; and this is Bradford's chief objection to it. Every user of wool knows how serious thick hairs are in a top and yarn, and undoubtedly the Romney is the chief cause of this serious trouble.

Another cause of trouble to Bradford buyers is the increasing quantity of black hairs seen in New Zealand wools. Here, again, it is largely a modern development, and arises from the increasing use of the South Down as a sire for the breeding of early-maturing lambs for the freezer. A great many pastoralists are now mating their crossbred ewes with the South Down for this express purpose; hence the big production there is to-day of so-called "slipe" lambs of 50's to 56's quality. No doubt, wherever Down rams are used in order to

gain early maturity of the sheep, they are bound to hand on this serious fault with all Down sheep except the Dorset Horn.

Another outstanding feature of the New Zealand wool trade is the fact that during the past dozen years there has been a steadily increasing production of 50's to 56's fleece wool. No doubt this was the direct outcome of the low values prevailing for the season 1921-22, when medium and low crossbred wools were selling in New Zealand at anything from 4d. to 6d. per lb., while half-bred wools (56's) never dropped approximately below 12d. That abnormal circumstance has now gone, and it is not likely to recur. To-day, we find the opposite prevailing - namely, satisfactory values for coarse wool and correspondingly low values for the finer crossbreds. There can be no doubt that a larger use of, say, stronger-woolled sires such as the Lincoln and Leicester, would satisfy Bradford requirements to-day, and certainly obliterate some of the outstanding faults which are proving to be a source of concern to Bradford and other users of New Zealand wools.

Another very good sheep which is considered to be largely responsible for the appreciable increase in 56's wools, is the Corriedale. This is a comparatively new breed of sheep evolved by a New Zealand breeder, and for all-round purposes is quite satisfactory. It produces a standard 56's quality fleece, and possesses considerable carcase value, as well as a valuable fleece. In our estimation, this sheep, producing as it does no black hairs in its fleece, can be used to considerable advantage in place of the South Down for the producing of quick-maturing lambs. There has been no shortage of 56's wools during the past two seasons, nor is it likely that there will be in the near future. This Corriedale sheep is a breed of sheep that has come to stay, for it has been found that it is suitable for both mutton production and wool growing. It is a dual-purpose sheep.

APPENDIX VI.

Suggested form to be supplied to wool-growers so that they may place it inside one or more bales of each lot of wool in order that the manufacturer may make a report on the wool.

Grower's Name: .....

Address: .....

Type of Sheep: .....

District: .....

BUYER'S REPORT.

Remarks on Bale Nos: ..... Brand: .....

Cleanness of wool: .....

Skirting of fleeces: .....

Classing of the Clip .....

Average spinning quality of the wool. .....

Ratio length to spinning quality: .....

Amount of kempy fibres present : .....

Amount of badly medullated fibres present: .....

Strength of wool: .....

If weak, where ? .....

General Remarks:

APPENDIX V11.

MANUFACTURING TESTS.

If it should be decided to try any more manufacturing experiments it will be necessary to have a round table discussion on what class of wools should be used in the trial. For example, in the fleeces sent from the North Island on this occasion there was hogget, ewe , and ram wool; and in any well-conducted experiment the fleeces should at least come from the same class of sheep so that comparisons may be made. There also is the question of how the fleeces should be prepared for the trial, who is to select the wool, and into what it is to be manufactured. If in the future it is hoped to obtain a report on each individual fleece, each fleece should be wrapped in a square of some cheap material, which should be marked with the number of the fleece, and an envelope, preferably of the window variety, placed in the fleece with a piece of paper inside showing the number of the fleece. If possible, some cheap paper also should be placed between the different folds of the wool in rolling it up so as to make unrolling easier, and to make sampling more certain. Manufacturers in Bradford are a little sceptical as to the value of any manufacturing trial carried out with a few fleeces, since small variations in condition, oil, etc., would be more marked in small lots than in larger consignments. While Leeds University and Bradford Technical College have small experimental scouring bowls and other plant capable of carrying out tests on about ten to twenty fleeces, Sir Frederic Aykroyd was of the opinion that probably best results would be obtained by placing about fifty fleece lots through a commercial mill.