

CANTERBURY FARMING

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IN Canterbury there are just over 8,000,000 acres of occupied land, the major part of which consists of:—

I. A grazing region of approximately 4,480,000 acres of tussock and other native grasses.

II. An arable region of approximately 2,720,000 acres, of which nowadays 600,000 to 700,000 acres annually are in arable crops, and the remainder in pastures which are ploughed up at h-regular intervals and used temporarily for the raising of annual crops.

From the above data it follows that the area of sown pastures annually is just a little over 2,000,000 acres.

I. The Grazing Belt

The grazing belt is devoted almost entirely to sheep farming, though some arable farming is done, mainly in the lower parts. It consists of steep hills and mountains, downs and river terraces, and of fairly extensive, fairly flat to undulating alluvial sediments which in some instances are spread out in considerable intermontane basins, for example, near Hanmer and Culverden in North Canterbury and the Mackenzie Plains in South Canterbury. It is the high country and foothills reaching westward to the main divide, the Southern Alps, together with the subsidiary ranges branching eastward therefrom. The vegetative cover is dominantly native grasses, in which native tussocks are often prominent, though in many places there occur English species of pasture plants, among which brown top (*Acrostis tenuis*) and sweet vernal (*Anthoxan-*

thum odoratum) are common and cocksfoot (*Dactylis glomerata*), white clover (*Trifolium repens*), and perennial ryegrass (*Lolium perenne*) are fairly common.

II. The Arable Belt

The arable belt, where sown pastures and arable crops are grown, consists mainly of the Canterbury Plains, the adjoining rolling foothill country and downs, together with relatively gentle valleys of the various rivers such as the Waimakariri, Rakaia, Ashburton, and Rangitata, the direction of which is roughly westward from the plains. In addition, the arable belt includes the following important arable-cropping regions:—

(a) The roughly-triangular portion of North Canterbury lying between Waipara and Parnassus and extending inward to about Waiau, and (b) the coastal strip extending about 20 miles northward from the Waitaki River. In the arable belt there is a wide range of soils varying from light, gravelly soils to heavy loams and including soils very rich in organic matter.

Sheep Population

In Canterbury, as in other provinces of New Zealand except Auckland and Taranaki, a major criterion of the welfare and productiveness of the grassland is the sheep population. In Canterbury in particular it is not so much the sheep numbers, but the sheep population (that is, both the classes and the numbers of sheep), which is

important, for in Canterbury ever the years there have been big changes in the classes of sheep as well as changes in the numbers. For example, in some places there has been a change-over, at times big, from Merinos to half-breds or Corriedales. In Amuri County, for instance, the percentage of Merino rams had changed from 18 in 1920 to 5 in 1945 and Corriedales from 13 in 1920 to 26 in 1945, and the general change in Canterbury is indicated by the fact that though the number of Merinos had fallen from 405,000 in 1926 to 338,000 in 1945, the number of half-breds had risen from 619,000 in 1926 to 1,134,000 in 1945.

There is no generally-accepted method of comparing the feed requirements of Merinos with those of half-breds; it is claimed by some that the feed requirements of 3 Merinos equal those of 2 half-breds, but others disagree with this ratio. It would seem that such a ratio in Canterbury is generally incorrect, though under some circumstances, as in parts of Mackenzie County, where half-breds usually are not kept, it may be virtually correct.

There have been other breed changes which are difficult to measure accurately. For instance, in Amuri 17 per cent. of English Leicester rams in 1920 had fallen to 6 per cent. in 1945, while less than 1 per cent. of Southdowns in 1920 had increased to 12 per cent. in 1945. Similarly in Cheviot 27 per cent. of English Leicester rams in 1920 had fallen to 3 per cent. in 1945 and 3 per cent. of Southdown rams in 1920 had risen to 15 per cent. in 1945. At the other end of Canterbury, in Waimate, 12 per cent. of Romney rams in 1920 had become 36 per cent. in 1945 and 1 per cent. of Southdown rams in 1920 had become 11 per cent. in 1945.

There has also been a change in the numbers of wethers. In Amuri wethers, which were 42 per cent. of breeding ewes in 1920, had become only 16 per cent. in 1945; in Waipara wethers, which were 15 per cent. of breeding ewes in 1920, were only 7 per cent. in 1945; in the central foothill counties (Ashley, Oxford, Selwyn, Tawera, and Malvern) wethers, which were 30 per cent. of breeding ewes in 1920, were only 12 per cent. in 1945, and in the Christchurch region (Waimairi Heathcote and Halswell Counties) wethers, which were 34 per cent. of breeding ewes in 1920, had fallen to 13 per cent. in 1945. At the southern end of the province, in Waimate County, wethers, which were 21 per cent. of breeding ewes in 1920, were 10 per cent. in 1945, and in Geraldine County wethers were 24 per cent. in 1920 and only 6 per cent. in 1945.

These figures show that it is difficult to assess how 1000 sheep carried in 1920 compare with 1000 sheep carried

in 1945, but with the major changes being (a) from Merinos to half-breds or Corriedales and (b) a drop in the proportion of wethers, it is apparent that the requirements of 1000 sheep today are greater than those of 1000 sheep in 1920.

There have been changes in number of sheep carried in various localities. For instance, six North Canterbury high-country stations which carried 81,000 in 1920 carried only 52,000 in 1945, six high-country stations in the Waimakariri basin which carried 49,300 sheep in 1920 carried 45,000 sheep in 1945, and 11 Mackenzie County high-country stations which carried 58,000 sheep in 1926 carried 59,000 in 1945; 11 Mackenzie County extensive sheep farms which carried 27,000 sheep in 1920 carried 25,000 in 1945.

In general, decreases in numbers of sheep carried have been in the grazing belt, but they have not been at all uniform and in fact increases have taken place at times. However, the grazing belt today is carrying less sheep than it did, say, 20 to 30 years ago. In 1920 there were 4,727,822 sheep in Canterbury, whereas in 1945 this number had been increased to 5,588,778 sheep and from what already has been stated it follows that the additional 861,000 sheep are carried in the arable belt.

Canterbury continues to be the most important arable-cropping province of the Dominion. In 1945-46 it grew approximately two-fifths of all the arable crops of the Dominion; Otago and Southland each had only about a third of the acreage of Canterbury, and the whole of the North Island had an area much less than that of Canterbury.

Though arable cropping is relatively so important in Canterbury, even in the arable regions, where cropping takes place most generally, pastures are easily the most important crop. There are approximately 2,750,000 acres of arable ground in Canterbury, and on four-fifths of that ground each year there are pastures, which are the main source of feed of the Canterbury fat-stock industry.

The pastures of Canterbury are influenced fundamentally by the fact that arable cropping is relatively so important. The length of life, the composition, and the methods of utilisation are all affected by the important place that has been given to arable cropping in Canterbury farming, where pastures differ from those of the North Island, in which arable cropping is comparatively neglected.

In many districts outside Canterbury most farmers seem to think that the longer pastures can be left without renewal the better it is, but in Canterbury's arable-farming area it is expected that pastures will be plough-

ed up after relatively few years. There are just over 2,000,000 acres of sown pastures in Canterbury and each year 200,000 to 250,000 acres are resown, so that on the average the life of sown pastures is 8 to 10 years! some lasting for a much shorter period and some for a substantially-longer period.

Though a fairly common age is 4 to 7 years, many pastures by design or accident have a much shorter life, but some sown pastures have a life of 12 years or more. For quite a long time the tendency has been to give Canterbury pastures a longer life. This is apparent from the acreage of crops grown and consideration of the fact that the smaller the acreage of arable crops the longer the pastures last in an arable-farming area. Cropping acreages have fluctuated greatly from year to year, but the general trend is given by the following figures:—

In the 3-year period ended	Average annual cropping acreage
1923	763,000
1933	699,000
1946	500,000

If this tendency continues much more, Canterbury will become largely a grass-farming area similar to the Hawke's Bay Plains and the Manawatu-Rangitikei district, in which cropping once was much more important than it is at present. Because of climatic differences Canterbury is not so suited for grass farming, as mixed arable farming, which is practised in Canterbury today, is more productive than when there is more dependence on grass alone. The downward trend in the cropping acreage has in the recent period been more rapid than it was in the earlier period.

In Canterbury there is more dependence on the ryegrass-clover mixture than in most other districts. This is due partly to the length of life of many of the pastures and partly to the extent to which seed production is a regular feature of the farm production. However, other species than ryegrass and clovers are fairly extensively used. Probably the main departure from the ryegrass-clover mixture is the use of cocksfoot on light plains country in substantial amounts.

There is also a fairly extensive and growing use of subterranean clover on land so inferior that white clover does poorly if it establishes at all. Subterranean clover has been grown in Canterbury for at least 30 to 40 years; but only relatively recently has it become of importance. This is because not until fairly recently has it been realised that success with subterranean clover calls for special management, which consists mainly of giving it a chance to reseed in the early stages and of dressing it with phosphatic manure.

There are approximately 750,000 acres of light, shingly land in Canterbury, worth today £9 per acre or less,

and much of this is known as light plains country. There are still limitations to the knowledge of the place and manner of using subterranean clover, but already enough is known about it to indicate that the productive capacity of much, if not all, of these 750,000 acres can be increased, at times substantially, in an economic manner by the suitable use of subterranean clover. In fact, in many instances the use of subterranean clover, in conjunction with the use of phosphatic fertiliser, will enable the carrying capacity of sheep to be doubled or more than doubled in a few years.

In general subterranean clover is of use, particularly on land which as it is at present is not good enough consistently to grow white clover well; occasionally on land somewhat better it may be advantageous to use subterranean clover, especially when such land suffers from dry summers.

Timothy is frequently sown in damp situations, especially where dairy farming is practised, and there is a widespread use of crested dogtail; there is a restricted use of *Phalaris* and alsike, and prairie grass and Yorkshire fog are not at all unknown.

The most important modern development in Canterbury pastures is that inferior strains of pasture plants, formerly in very common use, are today seldom used. Very much of the seed used is Certified seed and most of the remainder is closely related to Certified seed; more than a third of the acreages sown annually is either used for the production of Certified seed or could be so used. Seed may be sown either for grazing and seed production or for grazing alone. Much of the seed sown today is designed for grazing and seed production.

There is a great diversity of ideas even among good farmers as to what constitutes a good seed mixture if seed production is involved. For instance; in a recent examination of 500 seed mixtures used in recent years, it was found that though about 30lb. of ryegrass was the amount most commonly used, amounts of about 20lb. and of 40lb. were also fairly commonly used. To illustrate further the diversity in practice, in the same district one farmer used 48lb. of ryegrass while another used 16lb. of ryegrass, both for autumn sowing. In all these cases perennial ryegrass of high germinating capacity was used. Some details of the constituents of seed mixtures in common use are given by C. C. Leitch, Assistant Fields Superintendent, Department of Agriculture, Christchurch.

Sowing is carried out both in spring and in late summer and early autumn. Nowadays autumn sowing is regarded as likely to give good results though possibly it is not more popular than the spring sowing.

Latterly 120,000 to 140,000 acres of pastures, about half the total sown annually, are sown with companion crops such as cereals, rape, and turnips. Normally autumn sowing without a companion crop should give the best results. Many cling to the idea that the companion crop provides shelter, which undoubtedly is true, but it is not difficult to provide too much shelter for the fullest immediate development of the pasture.

The trend in liming in recent years is shown by the following figures:—

Season	Tonnage of lime delivered at Canterbury stations
1934-35	16,608
1941-42	63,935
1944-45	109,335

These figures show the trend but not the full Canterbury programme of liming, since an appreciable quantity of lime used has not been carried by rail. The area limed is shown in returns as 172,495 acres in 1944-45. This means only 1 acre in 15 of the arable belt alone. Hence, only a small portion of the land that could be limed with resultant benefit to crops is actually being limed, but the demand for lime at present, is so great that often there is much delay in its delivery.

Canterbury is well supplied with deposits of lime suitable for agricultural purposes and the maturing of plans already made will make substantially greater quantities available. Both field experience and official trials have indicated substantial benefit from liming on mixed Canterbury land.

Apart from a few minor cases, phosphatic topdressing only has been found of major importance in Canterbury. About 20 years ago a number of trials each of two kinds were carried out carefully. In the first kind there was pasture that had been established at least a few years and that was sometimes worn out or deteriorated. In the second a new pasture was used.

In the first type of trial there was little if any benefit over a period from the phosphatic manure and as a result it was felt that phosphatic topdressing of pastures was not worth while in Canterbury, notwithstanding that good results might be obtained in other districts of New Zealand. It seems now that the poor results from pastures established for some time may have been partly due to the poor type of perennial ryegrass that was then prevalent, mainly to the poor type of white clover that was often present (the stubble white type), and perhaps partly also to the weather in combination with these two other factors.

The second type of topdressing trial on freshly-established pastures containing good species and usually including ryegrass and clover in plenty gave quite good results when Certified

seed or its near equivalent was used, but often when the pasture seed was of indifferent type the results of the phosphatic fertiliser could not be considered enduring enough to be assessed as worth while.

Over a number of recent years many official trials and much observation of results on a field scale have presented widespread evidence of benefit from the use of phosphatic fertilisers on suitable pastures.

For a dozen years or so before the war phosphatic fertilisers had been growing in popular use for the topdressing of grassland, as the following data indicate:—

Year	Area topdressed in Canterbury with artificial fertilisers
1927-28	45,511
1937-38	158,274
1940-41	170,722

The year 1940-41 is the peak one in annual acreage topdressed, which, of course, decreased under rationing.

As yet topdressing with artificial fertilisers has had a very minor place in Canterbury grass farming. Probably the most significant feature is the steady increase, particularly in recent years, in the acreage topdressed. In the 1940-41 season 246 acres were topdressed with fertiliser for every 100 acres topdressed 5 years earlier. It is reasonable to assume that this increase has been based largely on favourable experience; probably to a considerable extent the earlier topdressing was a trial or of a tentative nature and because of the good results observed farmers have persevered with it, and, indeed, extended their topdressing programme.

Even in the peak year the amount of topdressing done in Canterbury was meagre in comparison with what is customary in some other districts in New Zealand. One of the factors contributing to this is that until relatively recently much of the pasture work on arable ground militated against good results from artificial fertilisers. The use of inferior strains of pasture species, for example, inferior ryegrass, most of which was perennial in name only, gave swards of such a short life of reasonably good production that artificial fertiliser used on such swards was less effective than it would be on the better swards which now can be produced reliably by the use of superior Certified strains.

A second factor that militated against success with topdressing was the application of artificial fertiliser to old pastures so deteriorated that inferior species such as browntop were prominent constituents or some ground was bare. Experience has shown that as a rule in Canterbury topdressing of land carrying such swards is inadvisable, whereas if the old, inferior sward is ploughed down and replaced by the

better and more vigorous one which suitable strains and species of seed will give, topdressing may be well warranted.

A third factor militating against the fullest success from topdressing pastures with phosphates has been the failure, which still fairly frequently obtains, to reinforce the phosphatic fertiliser topdressing by carrying out liming also. Farmers who fail to make joint use of lime and phosphates overlook the fact that a limiting factor in the response from phosphates may be a deficiency of lime, which is characteristic of much Canterbury land. The expansion of topdressing in Canterbury is retarded also by the rainfall not being sufficient to allow of results being as spectacular as they are in some of the heavier-rainfall districts. This is a circumstance which cannot be overcome in most of Canterbury, except in those districts in which irrigation is undertaken.

Though phosphatic topdressing, because of climatic conditions, does not promise to assume a role as great as it does in certain other major farming districts, the results from it will be improved by linking it with good swards and with liming; in any case there promises to be a substantial increase in Canterbury's programme of phosphatic topdressing and there is evidence that this increase will be justified.

The utilisation of pastures is more complicated in Canterbury than it is in most other districts, because it involves not only the use of the grazing animal, together with haymaking or silage-making, as a means of converting surplus summer growth, but also extensive seed production as a means of utilising surplus summer growth and extensive supplementary crop growing to tide over periods during which direct feed from pastures is in short supply.

Rotational grazing has not been exploited in Canterbury as much as in some North Island districts, but a few farmers have obtained distinct success with it in Canterbury, and probably in the future more attention will be given to it.

Canterbury farmers give much attention to the saving of summer surplus growth; in 1945-46, the latest year for which there are figures, 1 out of every 12 acres of sown pasture was utilised for hay, silage, or seed. The only other districts in New Zealand which approach the above ratio are Taranaki, where the ratio was 1 to 13, and Auckland, where the ratio was 1 to 16.

There is practically no silage in Canterbury and considering the weather conditions there can be little or no complaint regarding this neglect; usually the weather is good or reasonably good for haymaking.

Increasing attention has been given in Canterbury to the hay crop, as shown by the following table:—

3-year period beginning	Hay acreage
1920	19,000
1930	25,000
1943	44,000

The increase in the hay-crop acreage has been more rapid latterly. It seems reasonable to expect that the wider use of labour-saving machinery such as the pick-up baler will bring about further expansion of haymaking, which would have a favourable influence upon the winter feeding of livestock.

Seed production as a means of adjusting growth surplus to the current requirements of livestock has for decades been a feature of Canterbury farming. Originally seed production was accidental in that it took place if the stock did not need the feed, and the acreage devoted to seed production varied sharply from year to year according to the weather experienced in a particular year, especially during late spring and early summer. For instance, in 1924-25 the area devoted to seed production was 56,000 acres, in 1927-28 it was 27,000 acres, in 1930-31 39,000 acres, in 1931-32 24,000 acres, and in 1932-33 68,000 acres.

The area devoted to seed production is still dependent on the weather and to a less extent on the price offered for the seed, but it is much less an accident than it used to be. Nowadays an area is often sown with seed production in view; special, expensive machinery is available for the work, and seed production will be carried out as a routine farm practice if at all possible.

One result is that in the 4 years beginning 1940-41 the area devoted to seed production ranged only from 73,000 acres to 78,000 acres. In other words seed production from being a spasmodic or sporadic feature has become a regular and routine practice on many farms. From a marketing viewpoint this is desirable, as customers can depend on more regular supplies.

A feature of pasture-seed production has been the rapid expansion in the production of Certified seed during recent years. The acreages devoted to the production of seed of the better grasses and clovers during the past 6 years present some interesting features. The acreages relative to ryegrasses, cocksfoot, red clover, and white clover are set out in the table on page 32.

In 1947 the area entered for certification dropped to 91,586 acres. This drop seems to be both insignificant and temporary and there is promise of further expansion.

The changes during recent years

have been both an increase in seed production and a change-over from the production of seed of indifferent or indeterminate strain to the production of seed of a known good strain.

For the B-year period 1939 to 1945 the average yields of seed per acre in Canterbury were shown in returns as follows:—

Perennial ryegrass	14 bushels
Red clover	118.4lb.
White clover	117.6lb.

It seems probable, and there is some evidence to support the view, that the yields of Certified seed are less than the above figures, which relate to uncertified as well as to Certified seed; because of the better price for Certified seed, crops poorer than those from uncertified seed might well be harvested.

It is known that yields substantially higher than average are far from uncommon and it follows that one substantially lower must also be obtained quite often. Such lower yields require consideration. Some, but by no means all, may be due to unfavourable weather, some are due to saving seed from deteriorated pastures, and some low yields of clover may quite well be due to inadequate fertilisation because the number of suitable insects to effect pollination is insufficient.

Whether the causes are cultural, economic, or both, the matter of yields well below the average needs consideration.

When a man allows his seed-growing projects to dominate what is done on the farm he is for practical purposes a seed grower rather than a mixed arable farmer. In this sense there are very few if any seed growers in Canterbury, apart from those belonging to the recognised seed trade.

A large body of mixed arable farmers undertake seed growing as part of their activities. This is considered by some to have disadvantages, as farmers who specialise in seed growing might well be expected to be better in technique than those who do not specialise. There might probably

follow some improvement if there were specialisation in seed growing. But though here and there technique is inefficient, in general the mixed arable farmer carries out at least reasonably well the seed growing he undertakes, and in general the system of having such mixed arable farmers rather than specialised seed growers grow pasture seed seems to be in the national interest. The pasture-seed growing benefits by being integrated with arable farming in that often the cost of machinery used for seed growing is spread to other farm projects; in arable cropping there can be cashing of the accumulated fertility due to certain types of pasture-seed production, and generally arable cropping and pasture-seed production readily and suitably go hand in hand. Today tractors and header harvesters would not be as common in Canterbury if the arable farmer did not grow Certified seeds as well as grain crops.

Pasture utilisation is assisted in Canterbury to a substantial but decreasing extent by arable cropping. In the 3-year period ended 1925 an average annual area of green crops such as turnips, rape, and mangolds of 313,000 acres was grown, whereas in the 3-year period ended 1945 the average annual area had fallen to 230,000 acres. In addition, green cereals, the acreage of which has also fallen, are used.

These crops serve valuably in getting the stock through periods when the feed available directly from pastures is relatively small. They are part and parcel of the system of farming in vogue in the arable country of Canterbury; it is difficult, perhaps impossible, to ascertain accurately what they cost or are worth. It is accepted, however, that these crops are well worth while. The fact that there is a smaller acreage of supplementary crops than was grown about 20 years ago may be taken as due to an improvement in pastures, but it does not at all follow that any improvement in pastures should be associated in the reduction in the acreage of supplementary crops; rather, improvement in

ACREAGES DEVOTED TO SEED PRODUCTION AND AREAS ENTERED FOR CERTIFICATION

	1940-41		1942-43		1944-45		1946-47 *	
	Total acreage harvested for seed	Entered for certification	Total acreage harvested for seed	Entered for certification	Total acreage harvested for seed	Entered for certification	Total acreage harvested for seed	Entered for certification
Perennial ryegrass	36,346	3,590	23,410	8,319	28,409	16,561	42,238	38,275
Cocksfoot	13,186	3,665	8,025	3,470	8,179	6,341	18,058	13,140
Italian ryegrass	8,036				15,537			
White clover	7,413	219	15,650	475	14,042	11,018	34,068	25,027
Red clover		3,425	18,853	10,541	20,871	19,282	24,197	20,366
Totals	73,156	17,293	72,667	28,067	87,038	56,463	124,248	101,274

* 1946-47 certified acreages for perennial ryegrass and white clover include permanent pasture seed.

Canterbury's pasture might well mean improvement in numbers of stock with maintenance of supplementary crops.

It has been said that the production of Certified seed has led to neglect of other forms of production such as wheat growing and fat-stock production. The allegation in respect of wheat growing seems to have been true.

There is little doubt that one of the main causes of the relatively low yield of grass and clover seed in Canterbury is that the seed has been saved from paddocks which are beyond their prime because of their old age. Though often these paddocks would not have been ploughed up even if they were not used for seed production, at times the fact that a small crop of Certified seed could be obtained may have influenced the owner in deciding not to plough up a paddock. Such an operator is not doing the maximum either as an arable farmer or as a seed grower. His alternative course has been and is to plough more frequently, to grow more cash crops such as wheat where the fertility is accumulated, and to get subsequent yields of Certified pasture seed from more vigorous pastures.

Meat production may ultimately be affected in that there might come a day when all pastures are so good that to divert any of them to seed production would automatically bring about a reduction in livestock-carrying capacity and even then the seed production might well be warranted in view of the cash returns.

A charge has been made that the production of Certified seed has been developed in Canterbury to an extent that it has led to a falling off in the production of fat stock.

Undoubtedly on a farm on which all the pastures are really good such a result may be obtained, but the farms on which a falling off in livestock production has already been obtained are few if any.

What has been taking place on farms which have been increasing their seed-growing activities, over a number of years has been examined, with the following results:-

Initially the only fact known about the selected farms was that according to official seed certification records they had increased their seed production activities over a number of years. The period covered by the investigation was 1941-42 to 1944-45 inclusive. Twenty-four farms evenly distributed throughout Canterbury and totalling 9244 acres were considered.

In the first season 733 acres were devoted to seed production, which had grown to 1848 acres in the final season, the various crops grown being perennial ryegrass, Italian ryegrass, Montgomery red clover, cowgrass, and white

clover. The numbers of sheep carried were:-

	Season 1941-42	Season 1944-45
Ewes	9,633	10,672
Total sheep	11,544	13,651

Other changes were:-

1. In the beginning 42 per cent. of the farms were in good grass, compared with 48 per cent. in the later period.

2. Cereal crops declined while peas and potatoes increased, these changes being very similar on the selected farms and on Canterbury farms as a whole.

3. There was a sharp decline in the area in rape on the selected farms; otherwise the trend on the selected farms shows very little change from that on Canterbury farms in general.

In 1938 a committee of inquiry consisting of officers of the Department of Scientific and Industrial Research, the Department of Agriculture, the State Forest Service, Canterbury Agricultural College, and Victoria University College reported upon land erosion in New Zealand. This committee divided Canterbury into three regions and described them in the Department of Scientific and Industrial Research's Bulletin No. 77 as follows:-

1. The mountainous country, composed largely of greywacke. Erosion: Wind-sheet and gully erosion accompanying deterioration of tussock; shingle slides and gullies developing where beech forest has been destroyed.

2. The plains and adjoining foothill downs. Erosion: Largely controlled; some wind erosion.

3. Downs of greywacke sandstone, mudstone, limestone, etc. These lie between the first and second regions and mainly are not arable. Erosion: Some sheet erosion.

Apart from the mountainous region, it would seem from the foregoing that erosion had not become serious in Canterbury 9 years ago and that in the meantime the position has improved rather than deteriorated. This is because grassland farming, especially on the arable areas, was improved. Pastures have longer life and there is less cropping than there was about 15 years or more ago.

At times statements are made about soil conservation in Canterbury or allied subjects such as deterioration of vegetative cover that do not seem to take into account all practical considerations, and such statements must be discounted accordingly. For instance, it has been stated that a certain area in the upper Waimakariri basin today carries 44,000 sheep and years ago carried 66,000 sheep, the implication being that the degree of deterioration is to be measured by these two sets of figures indicative of carrying capacity. The figures are true, but the implica-

tion probably is not. First, the sheep, which nowadays are largely half-breeds, in the earlier days were largely Merinos and this forbids a straight-out comparison on the basis of figures alone. Secondly, there is no certainty that the region was ever capable of carrying 66,000 sheep. Indeed it is certainly possible and perhaps probable that when the area was carrying 66,000 sheep it was overstocked and that damage was done by this overstocking.

Again, it has been suggested that some special treatment such as strip cropping, terracing, or contour furrowing of Canterbury's downlands has become or will become advisable. It is well to remember that erosion of downlands today is generally much less than it was once, that at times today instead of erosion taking place soil fertility is being built up, and that as yet there is little or no knowledge of the economics of the new practices which are mentioned. In addition, there is a tendency to overlook the fact that under certain circumstances in Canterbury erosion is natural rather than induced by man and his animals.

To sum up, in Canterbury there is erosion that requires attention and study; but its real effect has at times been exaggerated and much of the induced erosion fortunately can be remedied best, not by special treatment, but by good farming. Today there are also guardians against undue erosion which did not exist until relatively recently. In Canterbury there are two catchment boards and a Soil Conservation Service specially designed to combat undue erosion. The biggest factor in the avoidance of erosion is the agencies that bring about better farming such as the Grasslands Division of the Department of Scientific and Industrial Research and the Department of Agriculture.

Somewhat briefly the general position in respect of Canterbury grassland is:—

First, there are 3,500,000 acres of native grasses. At times this has deteriorated only slightly if at all, but in general there has been visible deterioration due to the advent of the European. This deterioration at times is substantial, but usually is not as striking as some suggest.

It is virtually certain that substantial improvement of deteriorated native pastures is possible, particularly of the better ones, which often are favoured by at least reasonably good rainfall, though often what at first may seem favourable rainfall is offset by the prevalence of drying winds.

Factors of promise in the improvement of native pastures are:—

1. The systematic surface sowing of

useful pasture species, especially subterranean clover and white clover.

2. Topdressing with phosphates, especially of the better pastures where the rainfall and conditions generally are favourable.

3. Better grazing management, particularly the avoidance of periodical over-grazing, which occasionally has been due to rabbits.

4. Suitable action in respect of burning.

Secondly, there are slightly over 2,000,000 acres of sown pastures, and during the past 25 years there has been marked improvement in these. About 1,000,000 additional sheep are being carried today in comparison with 25 years ago. This is being achieved with a reduced area of fodder crops grown especially to assist the pastures. In addition, 1000 of the sheep carried today have greater feed requirements than those carried earlier in that today half-breeds are used in place of Merinos and breeding ewes instead of dry ewes and wethers. Further improvement of the sown pastures is clearly possible and the measures which will bring about such improvement are already being practised, the main ones being:—

1. The greater use of the superior strains of pasture plants.
2. More topdressing.
3. More liming.
4. Wider use of subterranean clover on light country.

As other districts have carrying capacities of 5 ewes, 6 ewes, and occasionally even more than 6 ewes per acre on grass alone all the year round, it is taken without question that on the score of carrying capacity only the Canterbury farmer is not at all in the forefront. But if consideration is given to the criteria of good grass farming that have been laid down by such authorities as E. Bruce Levy and Sir George Stapleton, and these criteria are accepted, as they usually are, it is necessary to take into account among other things how the farmers keep their pastures young, for they must be young in nature if not in age. It would also be necessary to take into account how the farmers manage during periods of high and of low growth and how they use up any building up of fertility that may accrue and of how they face the strong and weak points of their climate. If these various phases of farming are taken into account, the good mixed arable farmer in Canterbury ranks high in New Zealand. He at least is a good user of grass both from the individual and the national viewpoint and his returns in terms of capital value of his land are indeed excellent.