Mr. *A. Stuart* : What is a complex mixture ? I would be one for replacing the sward with a small number of species. You get sod-bound pastures-for instance, Chewings fescue. pastures-also straight brown-top pastures. which may be improved to a great extent by liming to bring in clover.

Mr. Harris : Southland pastures giving high production are chiefly of a rye-grass;- white clover: base, but with a considerable quantity of cocksfoot and timothy included. In connection with unpalatability, the invariable factor, to my mind, is the lack of balance in the principal elements of plant-food.

Mr. Cockayne : It i's perfectly clear that the question of the unpalatability of perennial rye-grass must sooner or later be settled ; it must not be left as it is at present. The main point regarding seed-mixtures **seems** to have been missed. It is this : where you have particularly good soil in New Zealand, or you make **it** particularly good by top-dressing and heavy stocking, and you sow with a wide variety of grass-seeds, including -perennial rye-grass and white clover in your original mixture, your essential pasture at the end of two or three years will be dominant perennial rye-grass and white clover. Now, of course, if perennial rye-grass is so unpalatable as to be objectionable and not advisable, the question that naturally arises is, **how** you are going to get rid of it. It does not matter whether you sow Chewings fescue, brown-top, and half a hundred other grasses, and 'you include even a moderate amount of rye-grass and' a moderate amount **of** white clover, and the growth from that pasture is sufficient to carry a large number of stock, your final pasture will be dominant rye-grass - white clover. In' other words, it is apparently fairly easy over a pond deal of country in New Zealand to develop what is termed a "habitat" which is essentially suited for perennial rye-grass and white clover. If some of the elements of that insignificant percentage are important and should be increased, how are we going to do it ? Inasmuch as I have said before, if you bring the ground up to a certain stage of fertility you have a certain degree of stocking on it. **It** automatically, provided you have sown perennial rye-grass and white clover, irrespective of whatever management you may adopt, will remain dominant rye-grass white-clover. A paddock near Foxton illustrates the relation between habitat and composition of grassland : here you could never get anything else but floating sweet-grass, because it is in a floating sweet-grass habitat. So all our farm-management which we view at the present time as being progressive farm-management is along the lines of developing a habitat which automatically makes that ground capable of producing dominantly rye-grass and white clover.

Mr. Smith : I agree that if you bring about that habitat you will get rye-grass - white-clover, but can we under ordindry farming conditions get that habitat ? I question whether under ordinary farming conditions we **can.**

Mr. *Cockayne :* High-production lands, in New Zealand are essentially rye-grass - white-clover. I am not quite sure whether high carrying-capacity is not being done to-the detriment of quality.

Mr. *Levy :* A passage which I omitted in the reading of my paper seems to be rather an important one [here Mr. Levy read a section from his paper relating to the control of environment before simplification of seed-mixtures *can* be carried far]. Relative to palatability, there is no question that if you sow rye-grass in low-fertility ground where it is stunted in growth and in habit, turning yellow with the winter frosts, and roasting in the summer through lack of vigour, the perennial rye-grass is extremely unpalatable. Perennial rye-grass is one of the best measures we have of the fertility of soil. If perennial rye-grass is not thriving and is not palatable, then you have to look to remedying-the fertility-of-the-soil

PASTURES AND THEIR IMPROVEMENT IN RELATION TO THE MANAGEMENT OF HILL FARMS IN CANTERBURY.

WITH SPECIAL REFERENCE TO PLOUGHABLE AREAS.

A. H. FLAY, Canterbury Agricultural College, Lincoln.

THE foothill areas of Canterbury consist of a large portion of the province, extending from the Conway River in the north to the Waitaki River in the south, a distance of some 230 miles. This same area varies in width from a few miles behind Methven, and Mayfield to some 80 miles in a part of North Canterbury, with much variation between these limits. Except in parts of North Canterbury, the climate generally is more severe and the rainfall higher than on the Plains. There is, of course, much variation. The soil, in general, is second class, but much variation exists, so that good rich pockets and small flats are not uncommon. Large areas of tussock and also of third-class land-poor, clay, scrub country-are prominent in certain districts. A rough estimate of the area of 'the foothill, farms in Canterbury is 2,000,000 acres.

A typical farm or small sheep-run in this area consists of some medium. flat land, a fair proportion of rolling downs with steep gullies, and possibly an unploughable tussock or scrub area. The total ploughable area varies considerably between properties, but on an average might be one-half to three-quarters of the area of the farm,: 'the total area of which might be 1,200 acres. The average carrying-capacity would be one to one and a half sheep per acre, and a few cattle would be carried. The sheep, in the main; are half-breds, but in many of the wetter and colder districts and on the sour, clay soils Romney sheep are preferred. Corriedales constitute a fair proportion of the sheep of North Canterbury.

'Ewe hoggets are kept each year for flock maintenance. Surplus four- and five-year-old breeding-ewes, fat and store' lambs, some fat ewes, store wethers, cull ewe lambs, and cull two-tooth ewes, together with wool and some cattle, constitute the main source of farm income. In recent times a few specially favoured properties with some suitable land 'have grown small areas of wheat and rye-grass seed. The production of these crops, however, is a precarious undertaking on account of the risks of winter flooding and strong winds and wet weather at harvest.

GENERAL FARM PRACTICES IN THE AREA.

Apart from the breeding of sheep and the general routine of sheep husbandry, the farm-management centres round the provision of winter feed, spring lambing feed, and some fattening feed. The constant breaking-up of old run-out pastures and the sowing-down of new ones is a very important phase of the management policy.

Turnips provide the bulk of the winter feed, green oats and newly sown temporary or permanent pasture what lambing green-feed there is, and rape, kale, and turnips sown with grass or alone' the fattening feed. On well-managed properties oat-sheaf chaff and,

to some extent, hay provide the reserve winter feed. There is nearly always adequate summer feed,. although in parts of North Canterbury, on account of the, dryness, summer and early autumn feed are often a more acute problem than winter feed.

New pastures are sown each year in the normal course of supplementary-feed production. They are nearly, always sown with one or other of the supplementary-feed crops previously mentioned, and are not usually sown with a view to securing a first-class permanent pasture. The success of the establishment of pastures sown in this fashion depends on the seed-mixture used, the soil condition at sowing, the strike and vigour of the supplementary crop, the severity of the grazing when the supplementary crop is being eaten off, and other factors which usually are considered not from the point of view 'of securing first-class pasture, but rather from that of a first-class 'supplementary crop. The result is that such new pastures, at their best, can only be mediocre. They soon deteriorate to inferior swards, which sweet vernal and brown-top readily invade and soon dominate.

The soils in these areas respond to top-dressing with phosphate and lime, a practice which, because of the poorness of the new pasture, can rarely be considered economic. At any rate, systematic pasture top-dressing is rarely practised. Though the best permanent pastures are desired they are secured only occasionally by the "chance" or "hit and miss" principle of the use of unsatisfactory seed-mixtures and sowing-down methods. Even when the .best seed-mixtures are sown and "chance" good pastures are secured, these are rarely top-dressed and therefore are not maintained.

PRESENT PASTURES.

The greater proportion of the pastures on the foothill areas are poor, and consist mainly of brown-top, sweet vernal, danthonia, some creeping-fog, trefoil,. hair-grass, and other low-producing species. Some volunteer white clover and odd cocksfoot and rye-grass plants are present in a few pastures. Often dogstail, and occasionally timothy, are to be found. Brown-top and sweet vernal, though, are the dominant grass species, and often form dense turfs of badly grazed and unpalatable roughage. These pastures give a low carrying-capacity.

Improperly sown new pastures, because of their openness at the start, soon become invaded with these low-producing species. Without manurial treatment the good species that may -be sown and that have survived the maltreatment associated with the turnip or other supplementary companion crop- cease -to- retain their vigour after the first year. Such pastures steadily deteriorate, giving a progressively lower grazing-capacity, and subsequently the brown-top becomes sod-bound, with a still lower grazing-capacity. If it were not for the cost of renewal and the fact that all the other pastures on the farm are waiting to be renewed, such a deteriorating newly sown pasture could, with advantage, be ploughed, and again renewed in its third or fourth year. The pasture, however, may not be renewed for eight or even more years.

A low carrying-capacity of a poor-quality feed means low production, and consequently acts as a limit to farm income. Because of this, the pastoral problem on the foothill areas is most

important, and, provided there is good farm-management generally, the farmer's maximum profits depend upon the success with which this problem is handled.

AN IMPROVED METHOD OF SOWING GRASS ON THESE AREAS.

As already stated, turnips are sown for winter feed, green-feed is required in spring, and some fattening feed is usually grown. By a: reorganization of the cropping programme to allow the sowing of turnips alone or with a very light seeding of- Italian rye-grass, the land, after the turnips are eaten off, can be ploughed in' the spring, given ideal treatment in the average 'season, and sown to grass in November-December or January-early-February. On land where annual weeds such. as spurrey are troublesome, ideal preparation of the seed-bed should be continued until February to allow early autumn 'sowing. The inclusion 'of ½ lb. per acre of rape, kale, or chou moellier gives an extra bulk of fattening feed without harming the new grass by smothering or by excessive tramping as when feeding-off a heavy supplementary crop. The grass (and clovers), because of the fallow, the manure used, and the time of sowing, forms a dense sward of desirable species from the commencement, thus giving little opportunity for the invasion of' inferior species, Liberal top-dressing in the first year, followed by annual top-dressing, together with suitable grazing-management, maintains a first-class sward of high carrying-capacity on any of these areas.

The value and importance of sowing in this fashion lies in the fact that a dense complete sward of desirable species is obtained at the outset. If followed up by a regular systematic top-dressing policy such a sward can, be maintained indefinitely, whereas a poor open pasture on this class of ploughable land can never, within the bounds of practical and economical farming, be improved except by ploughing and resowing.'

PASTURE SPECIES SOWN: SEED-MIXTURES.

Improved permanent pastures have "been secured by sowing various mixtures under different conditions of soil and climate. The species included in these mixtures have been true or certified perennial rye-grass, cocksfoot, timothy, dogstail, ordinary red clover, certified white clover, subterranean clover, Montgomeryshire red clover, and lucerne. All of the following mixtures, as well as others not given, have been sown on different farms. On several farms two or three of these mixtures have been used on different fields at different times.

Seed-mixture Sown (Pounds per *Acre*).

—	(1.)	(2.)	(3).	(4.)	(5.)	(6.)	(7.)	(8.)	(9.)	(10.)	(11.)	(12.)	(13.)
Certified perennial rye-grass	30–35	28–30	28–30	30–35	30–35	28–30	28–30	28–30	4-s	4–5	28–30	28–30	28–30
Cocksfoot : Minimum germination 75 per cent.	..	8–12	8–12	..	..	8–12	8–12	8–12	12–15	12–15	..	8–12	8–12
Certified white clover	..	..	1–2	1–2	1–2	1–2	1–2	1–2	1–2	1–2	1–2	1–2	1–2
Red clover	4–5	4–5	3–4	3–4	..	3–4	3–4	3–4	3-4			3-4	..
Montgomeryshire red clover	..	..	..	..	3–4	..	..	..	..	3–4	...	3 - 4	3–4
Subterranean clover	..	..	..	..	..	1–2	..	..	.	.	.	.	1–2
Lucerne	..	..	..	..	..	..	..	..		2–4	2-4	2–4	
Timothy	..	..	..	..	..	..	1–2	..	.	.	.	.	.
Dogstail	..	..	..	..	..	..	..	½–1	.	.	.	.	.
Total..	4–40	40–47	40–48	34–41	34–41	41–50	41–50	40½–49	21–27	22–30	33–38	43–54	40–48

It will be seen at a glance that all,. permanent-pasture seed-mixtures contain true or certified perennial rye-grass, most of them include cocksfoot, 'and a very large proportion include wild, or certified white clover: Red clover also is very commonly used when'sowing down these improved permanent pastures. During' the last' year or so,, with the-cheapening of 'Montgomeryshire red-clover seed, this plant has been used in a few instances. It is anticipated that it may gradually replace red clover as farmers themselves gain more experience of the value of high-producing permanent pastures and the use that, Montgomeryshire red clover can be in these swards. Timothy and dogstail are added to the mixture' by some farmers in certain districts: Subterranean clover is being sown in the seed-mixture used on the poorer Soils in' parts of' North Canterbury, and could be used more extensively' with advantage. Lucerne is sown in the grass mixture only' in parts of North Canterbury, and here it performs the very useful function of giving feed longer into the dry weather-than other species.' Because cocksfoot is partially smothered by and eaten out -in a vigorous rye-grass stand, some farmers have omitted it from. their mixtures: On all the better and heavier soils this'docs not appear to be a disadvantage. Regardless, almost, of soil or locality under Canterbury foothill conditions certified white clover should always be sown. It is the foundation of improved and top-dressed permanent pastures. On the poorer soiis subterranean clover should, on. at least a large proportion of the farm, be a companion to white clover in soil and pasture improvement. Of the mixtures given, No. 3 and No. 4 are the most commonly used. A few fanners are using Nos. 5, 6, and 13. In North Canterbury No. 10, No. 11, and No. 12 are in favour. No. 1 cannot be recommended for a permanent pasture, and No. 2 is inferior in value' to No. 3 unless a good growth of volunteer white clover can be brought about by top-dressing. Dependence on volunteer white clover, however, is definitely not advisable.

MANURIAL TREATMENT AND GRAZING-MANAGEMENT,

Liberal manuring and liming when sowing and during the first year of the life of the new permanent pasture is most important. Common practice is to use 1 cwt. to 1½ cwt. of superphosphate per acre at sowing-time. Top-dressing is commenced in the first autumn with 1 cwt.- to 1¼ cwt.. of superphosphate. and 4 cwt. to 5 cwt. of carbonate of lime. Subsequently about 1 cwt. of superphosphate is applied each autumn, and 4 cwt. to 5 cwt. of lime at two- or three-year intervals. With this manuring on the poorer soils a stage of pronounced weakness is often apparent during 'the- second year of the life 'of the sward.'.

In one instance, on poor clay soil on one of these foothill farms, 3 cwt.- of superphosphate and 3 cwt. of lime (carbonate) were sown with the seed in early February, 1 cwt. of super-phosphate and 5 cwt. of lime applied in April as soon as the new sward would carry the drill (used for top-dressing), 1 cwt. of super-phosphate applied the following spring, and 1 cwt. of. superphosphate applied the same or following autumn, which was last autumn. The pasture is now one and' a half years old. It is an excellent sward. The certified white clover and the red clover have developed, the rye-grass has already passed through a slight weakening stage, and the cocksfoot is growing well on this poor Soil, which " would not grow good permanent. pasture " according to

all local evidence. This is on a farm at present carrying half a sheep per acre. The new pasture, the first of the improved type on this farm, has averaged just over two sheep per acre since sowing, as well as producing 20 bushels of perennial rye-grass last summer.

The grazing-management 'has been along the usual lines of judicious controlled grazing-Le., the new pasture has neither been punished nor allowed to get out of hand. It has, during the period, been grazed to suit the pasture.

A special feature of the grazing-management, however, in the first and second summers following spring sowings and the first summer following autumn sowings is to graze the pasture lightly or to spell it entirely for approximately a two-months period in summer-November-December or December–January appear the best periods- for the purpose of allowing clovers to develop. The particular pasture in question was shut for rye-grass seed on the 1st November, mowed and header-harvested in January, and not grazed until 23rd January, by which time there was a good second growth of red and white clover.

The poorer the soil the more important is this treatment on account of the value of clovers in the building-up of the rye-grass of the sward. On really good soils little spelling, if any, may be necessary. This practice of spelling should not be such that growth gets out of hand, but merely sufficient to allow the clovers, which are readily eaten out in a sward of relatively unpalatable permanent rye-grass, especially on poorer soils, to develop freely and become established as an integral part of the new permanent pasture.

IMPORTANCE OF TOP-DRESSING.

Some farmers havc occasionally put this policy of pasture renewal into practice and omitted on one or two paddocks, or, worse still, perhaps, on the first pasture sown the necessary manurial treatment. For the first six months, year, or perhaps eighteen months, according to the quality of the land, the new pasture has been apparently all that was expected, but soon the rye-grass has become hard and unpalatable, clovers have failed to develop, and inferior species have entered readily. Disappointment has been the result, and the policy for improvement abandoned.

It has become demonstrated amply that unless a suitable annual top-dressing programme has been conscientiously followed any policy for pasture improvement on these soils is only of passing value. Experiences to date are convincing that there is no permanent gain by properly sowmg valuable pasture-seed mixtures without fertilizer.

SOME BENEFITS FROM IMPROVED PERMANENT PASTURES ON FOOTHILL FARMS.

Improved permanent pastures of high carrying-capacity mean improvement to the farmer's property. His assets are increased. The only measure of this increase in assets is the increase in productive value (or net returns). This is. very largely dependent upon the area sown to good pasture and maintained as such. Very few farmers, if any, in the foothill area have definitely planned a pasture-improvement policy along the lines indicated for more than five or six years, so that assuming an annual sowing-down of 5 per cent. to 7 per cent.

of the farm (and without capital expenditure little more than this area can be sown down annually) the yearly increase in assets must of necessity be small. There remains a large area yet to be dealt with, and much scope for increasing carrying-capacity, and thus assets, on. most' of these properties.

Over the short period. of development mentioned, several properties have increased their sheep numbers by 20 per cent. to 25 per cent., a large number by smaller percentages, and one property by 46 per cent. It is safe to forecast that many of these properties will more than double their carrying-capacity as development progresses.

Efficiently managed, improved, and top-dressed pastures also enable more lambs to be fattened on the mothers, and frequently, in consequence, allow a greater total number of fat lambs to be produced than would otherwise be the case. Thus the percentage of lambs sold as "stores" is reduced. There is ample evidence of this.

Under the improved conditions outlined there is the usual or greater quantity of winter feed for sheep. A greater and longer autumn growth, some and more winter growth, and a greater and earlier spring growth is obtained from improved and top-dressed pastures than from inferior ones. This additional growth in the "off" season may be such that, although sheep numbers may be very greatly increased, the provision of additional areas of winter supplementary feed such as turnips is unnecessary, though under these conditions hay or ensilage, or both, provide the reserve. An extra grass-feed supply in winter is often reflected in an increase in lambing percentage and lambing survival. An increased wool clip per sheep shorn is one of the first benefits of good pasture and adequate feed. It is not uncommon to have increases in lambing percentages of 5 per cent., 10 per cent., and even 15 per cent. The wool clip has been improved on several properties by 1½ lb. per sheep (and this half-bred wool, too). In one instance the clip per sheep has been raised from 7¼ lb. to 9¾ lb.

On many foothill farms hogget mortality, due mainly to worms and malnutrition, is high. On one property, by the aid of clean, uncontaminated new pasture used for winter feed along with chaff and hay, hogget mortality has been reduced without drenching over a three-year peripd from 20 per cent. to 3 per cent. It is not claimed that the improved new pastures were in themselves responsible for this, but the policy of pasture renewal introduced four years ago allowed the hoggets to be grazed on clean feed. On other properties also significant reductions in hogget mortality have been secured.

All the above benefits, if not due directly to improved pastures in-themselves, are distinctly associated with and very largely dependent upon practising a pasture-improvement policy. There is no other more economical method of securing on these areas the benefits outlined.

FINANCIAL ASPECT.

, On nearly all foothill- farms there is a team or power unit used in the cultivation and cropping programme. The new policy that allows the proper sowing of grass does not usually entail any great increase in the area cultivated each year, but rather a rearrangement of the cropping rotation. There is, however, a little extra surface cultivation

for new permanent pasture. For a typical farm carrying 1,600 sheep the cropping under the old and the new methods -might be compared in the, following manner :-

	Old.	New (first few Years).
	Acres.	Acres.
Turnips and grass	80	
Turnips		80
Rapeandgrass	40	
Rape		40
New permanent' pasture		80
Green-feed oats and grass	40	
Green-feed	40	40
Oats (for chaff):	40	40
	"40	280

There is really no significant extra team 'or power-unit costs- for cultivation, the' few extra acres being handled usually by the present units at more or less a fixed overhead charge. Grass-seeds may cost an extra 5s. to 10s. per acre, or even more, but this cost is offset by a reduced area being sown down and by a smaller seeds account for the saving of green-feed. The manurial costs are, however, increased, and at progressively greater annual cost as development (which includes top-dressing) proceeds. This sometimes is partly offset by the sowing of -permanent rye-grass for seed. Usually, however, top-dressing has to be reckoned as a direct charge against the benefits derived, from growing improved pastures-a charge which is substantially offset by increased carrying-capacity, extra fat lambs, heavier wool clip, and so on.

Over the years,, other things being equal, a policy of pasture improvement can only result in increased net returns. This has been demonstrated in practice by progressive and successful farmers. Where development, however, is more rapid than that permitted by the usual cropping programme, then, not only are seed and cultivation costs increased, but also proportionately larger numbers of ewe hoggets and four- and- five-year-old ewes must be kept from. sale, thus reducing receipts.' At the same time manurial and top-dressing costs rise rapidly. Income from these improvements lags to some extent, and so trading accounts may show deficits while capital accounts for the same properties show improvements. Ready cash is usually needed for rapid development, which cannot be recommended unless capital expenditure and tlie long view are reckoned upon. Over-anxious and enthusiastic farmers sometimes develop their properties more rapidly than their resources make advisable.

WHY A PASTURE-IMPROVEMENT POLICY, IS NOT AND HAS NOT BEEN GENERALLY ADOPTED.

Some explanation why grass is and has been sown in an unsatisfactory fashion with turnips, rape, and other supplementary crops now seems

necessary. Failure to adopt 'the practice' 'of top-dressing when only poorpastures of a more or less temporary nature were available should need no comment.

The idea, of a supplementary crop and a pasture being produced for the one and same cultivation and manurial cost has always appealed. Further, good permanent-pasture seed-mixtures, including true perennial rye-grass, have not been generally available, and thus, regardless of the method of sowing and subsequent treatment, the temporary rye-grass in the seed-mixture has *quickly died out and left much bare ground for the establishment of inferior species. This rapid " running-out " has necessitated the renewal of large areas each year; with the result that 'pastures more or less have had to' be sown every available opportunity--i.e., with every. supplementary crop-in an attempt to cope, with the large areas awaiting the plough. This state of affairs has been characteristic of many farms, and unavoidable on those where temporary perennial rye-grass and red clover alone have constituted, the pasture-seed mixture. As previously explained, 'the method of sowing also adds to the subsequent poorness and- openness. of the new pasture. Top-dressing on these areas has never been able. to compensate for an unsuitable seed-mixture sown indifferently or otherwise.

The balanced-feeding value of turnips and grass and rape 'and grass is also an important factor favouring the sowing of grass with a supplementary crop. Progressive farmers, however, who are' practising an improved grassing policy and cannot feed a good run-out of pasture, hay, or chaff, or both hay and chaff, along with their turnips usually sow with them ½ bushel per acre of Italian rye-grass. The turnips are grubbed in the usual fashion and the land ploughed for the, sowing of new permanent grass in the approved method, regardless of the Italian. rye-grass that may still be present.

AN EXAMPLE OF PROGKESS ON A FOOTHILL FARM.

A few particulars of progress and development under an improved grassing policy on a foothill farm should be of interest. The farm is situated near the Kakaia Gorge, on the Lake. Coleridge road. The altitude is about 1,500 ft. Falls of snow in winter are often experienced. The area of the property is 800 acres, of which 60 acres are in plantations and 100 acres are in' steep hilly tussock. The remainder comprises flats and gentle downs. A medium-quality loam grows natural pasturage of brown-top, sweet vernal; -trefoil;- &c., as well as some tussoc'ks.

In 1932 turnips and grass were sown together and provided the winter feed as well as the new pasture. No fattening feed was grown at that time. The cropping last season—1935–36—consisted of 45 acres of turnips and swedes, 64 acres of new permanent pasture sown with ½ lb. rape per acre. In the past chaff has provided what winter reserve feed has been used. The total area sown to new pasture to date in the improved method is 130 acres. Particulars of stocking, sheep shorn, wool-yields, total death-rate (all sheep), and lambing percentages over a period of years are given in the table on following page.

Particulars of Stock Numbers, Sheep shorn, Wool-yield, Total Death-rate (all Sheep), and Lambing Percentages for Period 1930 to 1936.

Year.	Stock, 30th June.		Sheep shorn.	Wool-yield per Sheep.	Total Death-rate in all Sheep.	Lambing Percentage (calculated on Ewes put to Ram).
	Sheep and Cattle.	Sheep Units. (1 Cattle Beast = 6 Sheep Units.)				
				Lb.	Per cent.	Pet cent
1930 . .	..	..	869	..	..	67
1931 . .	860 sheep, 57 cattle	1,202	751	6¾	6	73
1932 . .	856 sheep, 70 cattle	1,276	791	7¾	6	70
1933 . .	1,057 sheep, 7 cattle	1,099	939	7	13	66
1934 . .	1,100 sheep, 15 cattle	1,190	939	7¼	13	78
1935 . .	1,235 sheep, 17 cattle	1,356	925	9¾	8	86
1936 . .	1,632 sheep, 20 cattle	1,752	..	..	..	..

The first new pasture to be sown in the improved fashion after turnips consisted of 30 acres. It was sown in early November, 1933, with 35 lb. permanent rye-grass, 10 lb. cocksfoot, and 5 lb. red-clover seed per acre. and also, 1 cwt. superphosphate per acre. Grazing was commenced in January, 1934. Top-dressing with 3 cwt. per acre of carbonate of lime in June, 1934, and 1 cwt. superphosphate per acre in early September, 1934, was carried out. It was also top-dressed in the autumns of 1935 and 1936 with 1 cwt. superphosphate per acre on each occasion.

The grazing-capacity as dry sheep per acre since establishment is given below by months :-

Year.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
1934 ..	7·63	14·50	9·20	8·96	3·59	...	..	..	0·70	5·20	2·30	1·40
1935 . .	9·70	11·30	3·10	6·90	1·09	4·54	..	1·47	1·21	4·21	5·60	10·57
1936 . .	6·77	0·28	7·24	2·20	1·89	..	..	...	..	..	..	..

The average number of dry sheep carried per acre for a period of thirty months was 4·43. This carrying-capacity is especially significant in view of the fact that the carrying-capacity of the farm as a whole prior to this winter has been only 1½ sheep per acre. The light grazing in November and December, 1934, was purposely carried out to allow of clover development as discussed earlier. Up to this last autumn, when some damage by grass-grub has been experienced, this particular pasture was a good dense sward with a low proportion of sweet vernal and some trefoil in association with the higher-producing species. Cocksfoot was not very prominent, but on this land volunteer white clover is excellent. So far brown-top is practically non-existent in this pasture.

ACKNOWLEDGMENT.

For the particulars and the figures quoted in the example given thanks are due to Mr. H. T. Richards, The Point, Windwhistle.

DISCUSSION.

MY. *Stafford :* The earlier history of Canterbury shows that originally the foot-hill country was successfully farmed in large areas, which were run in conjunction with down-country farms. The practice was to breed lambs on foot-hill country and bring surplus stock -down and fatten them. With cutting-up in the foot-hill country the settlers attempted unsuccessfully to carry out the same style of farming as was carried out on the plains. The successful farming of the foot-hill. country of Canterbury lies in the establishment of suitable permanent pastures. Previously the method of obtaining suitable permanent pastures was not known, hut now we have sufficient information to enable the farmer in the foot-hill country to establish a permanent pasture, and to go on to a farm that has " run out " and, by means of turning over a certain proportion of his land every year, sow it down with a permanent mixture, knowing he will not have to go back on to that pasture for some years to come. In South Canterbury we sow the pasture in February or March, rather than in November or December ; this is because of the troublesome common weed, spurrey. Certified white clover has not been a success. Montgomery red clover is performing better than white clover, and for the rainfall that is experienced and the clay land red clover is more satisfactory than a good type of white clover. If liming is deferred until the pasture clearly is well established one is assured of benefit from it, whereas if establishment is not successful benefit from lime is lost in turning over the land.

Mr. Marshall : I agree that in South Canterbury good establishment results from sowing earlier than Mr. Flay recommends. In those seasons when you have good climatic conditions and can sow in that month, you get a good summer feed and a good establishment. Regarding the working of the land after turnip crops, I disagree with Mr. Flay, because in working the land to 4 in. or 5 in. you lose the consolidation, which is essential to the establishment of a good pasture. Without consolidation on foot-hill country a poor, spindly type of rye-grass develops. To obtain consolidation and to keep the droppings on the surface I like to lightly cultivate the surface and broadcast the seed, but I hope in future to be able to drill in 3½ in. centrcs. In regard to liming, 1 agree with Mr. Stafford that it is desirable to make sure the pasture is established. I like a ton to the acre on this country. Mr. Flay recommends up to G lb. or 8 lb. of cocksfoot. I have not found it successful. If you want a cocksfoot paddock you must sow cocksfoot and not hinder it with rye-grass. There are isolated cases where this not so, of course. We have had great success from Montgomery red clover this year. We have found definitely that Montgomery red clover thrives under hard grazing. Hard grazing together with intensive stocking, improves the rye-grass through the nitrogen. If you have a pasture which is very palatable because of plenty of clover you can keep your grass short at the period when the beetle is laying the egg of the grass-grub, and I have found, where we are able to carry out pasture-management as it should be carried out, the loss of pastures through grub is negligible.

Mr. Flay : Relative to sowing in February or March rather than in November or December or early January or February, no one appreciates consolidation more than myself, but where you have ploughed 4 in. to 5 in. deep and then over a period of one, two, or three months harrowed, you automatically get the best consolidation that is practically possible. At the same time, while you are harrowing and consolidating the soil you also get successive strikes of spurrey in the first one or two inches of the soil and you can reduce the density of the spurrey in the young pasture. A disadvantage of February or March sowing is the windy weather, and, further, then it is getting a bit late for the high areas, and so there is less certainty of a good clover-strike. I would not recommend Montgomery red clover without including certified white clover. I would have both and some subterranean clover- as well. It is advisable to apply lime when you have a good pasture, but one cannot fail to get good grass if the land is prepared properly and the seed is sown when the land is ready-as soon as the turnips are removed in September it is advisable to prepare the land, except in parts **of North** Canterbury where it is very dry. 1 cannot understand why a good white clover is not successful in South Canterbury. It may be due to the time of sowing or to some other cause, but in my experience white clover, managed properly, is excellent with Montgomery red clover.

Mr. Harris : I have noticed where the establishment of cocksfoot by drilling has been more successful than where cocksfoot was included in the general mixture and sown on top of, the ground.

Mr. Flay : If you can get the seed-bed as nearly as possible ideal in the. first instance, and drill-the cocksfoot you get perfect strikes. WC have sown it successfully on our medium and light lands.

Mr. *Harris* : When the cocksfoot is drilled in the crown of the cocksfoot is lower into the ground and the pasture stands more severe grazing.

Mr. *Flay* : I think there is a good deal in that point. In the drilling of the cocksfoot it is necessary to be absolutely certain that it is not drilled too deeply— below an inch a poor strike results, while about half an inch gives a successful strike.

Mr. Cockayne : I totally disagree with the last speaker. The theory that you can bury your seed and alter the growth of the plant is radically wrong. Whether you sow cocksfoot on top or in the soil it is essentially a tussock plant and develops roots from near the surface. The system which is revolutionizing the laying-down of pasture on refractory soils in the north is the one being adopted in the Canterbury conditions being considered. Top-dressing with the seed and a top-dressing rapidly following this seems to be the basis of the formation of permanent pastures on a good many of the refractory soils in the north, such as gum land, poorer pumice-land, &c.