FIELD DAY

W. J. REID AND SONS, "TRAQUAIR"

Speaker: Mr R. J. REID

Description of Property

The holding can be roughly divided into 4 blocks:

1. The clean, better class lowland around the homestead;
2. A belt of scrub-infested country;
3. A large clean area of fescue and browntop with tussock;
4. Snow tussock, summer country of the Maungatua Range.

Soils are mainly derived from micaschist, but as a result of weathering and leaching are deficient in lime, phosphate, and molybdenum.

History of Development

Before 1947 the holding was under run management, involving the breaking-up of an area in scrub each year for turnips. After 2 crops it was sown down to pasture without lime or phosphate and such areas reverted to scrub within 10 years. Under this programme the scrub was spreading through several blocks, but following the practice pioneered by Eric Lake in collaboration with Extension Division Instructors, 1 ton per acre of burnt lime applied 8 months before sowing Green Globe turnips with 1⅔ cwt of reverted superphosphate through a grain drill gave very good results. After feeding-off the area was either reploughed and surface cultivated, or disced before being prepared for a second crop of turnips sown with the same manurial treatment as for the first crop. It was later disced and sown down to permanent pasture with the following mixture:

20 lb perennial ryegrass
6-8 lb cocksfoot
3 lb crested dogstail
23 lb white clover
3 lb Montgomery red clover

We now apply 30 cwt of carbonate of lime per acre after ploughing and sow down with 24-3 cwt of molybdenised superphosphate. The use of molybdenum has reduced the rate of liming from 3 tons to 1½ tons per acre.

All pastures are now spring sown with 1-1½ lb of rape per acre and 16 months after establishment 1½ cwt per acre of D.D.T. superphosphate is applied to combat grass grub and subterranean grass caterpillar. Maintenance dressings of 3 cwt per acre of superphosphate are applied in autumn every second year.

Roller Drill

Under dry conditions this implement gives good results in that a good establishment of all species can be secured with total seeding rate of 22-24 lb per acre, which reduces costs materially. Disadvantages are that with heavy applications of fertiliser frequent refilling is necessary and on large areas this is time-consuming and costly, while on damp soils the roller rings become clogged.

Sod Seeding and Clover Inoculation

An improvement programme was begun in 1951 on the fescue and browntop country adjoining the wool-shed and dip. We could not cope with this development in addition to the scrubland reclamation by conventional methods, so various means of surface cultivation and sowing 4-5 lb of clover seed per acre were attempted. Results were poor, but by using Blackmore coulters on a grain drill sowing 1½ lb per acre of certified white clover, following an application 6 weeks earlier of 30 cwt carbonate of lime and 1 cwt per acre of molybdenised superphosphate, good establishment was obtained. Plants later deteriorated until November/December when generally unthrifty appearance and yellowing of leaves indicated a marked deficiency of some requirement. Clover inoculum was sprayed over the area at varying strengths of solution without success. Trials with a series of clover inoculations, carried out in collaboration with the Plant Diseases Division, Auckland, and local Extension Division officers supplied data for the production of an inoculum required for successful establishment of clover. There were 15 strains of inoculum under investigation and 5 of these were consistently superior, but in my opinion this important project should be investigated much more completely. In view of several practical difficulties encountered in treating clover seed to ensure successful establishment and vigorous growth in the pasture, accurate knowledge on the best strains and most efficient methods of seed treatment would pay handsome dividends. Our present practice is to apply 30 cwt of lime per acre a year before sowing and then introduce 1½-2 lb of white and 23-3 lb of Montgomery red clover seed per acre with 2 cwt of reverted molybdenised superphosphate. All clover seed is treated with inoculum and good establishment is secured, improved areas giving increased carrying capacity up to 1-2 ewes per acre and in one block a good return was secured from clover seed harvested.

Several methods of sowing on unploughed areas have been tried out and of these the sod-seeder was somewhat disappointing owing to difficulty in controlling depth. In our experience broadcasting gives as good results as any other, but admittedly in the last two seasons we have had the advantage of unusual rains to ensure adequate moisture in the soil during August/September, which we think is the most suitable time for this work.

Eventually, the areas improved by clover introduction and fertility build-up through stock grazing will be ploughed, cropped, and sown to pasture by the conventional rotation. Experience on similar country has already shown that crops are much heavier yielding after this treatment, than where the native or reverted pasture is ploughed, fallowed, and sown to a feed crop, in the conventional method. For the relatively small expenditure on surface or similar sowing of clover seed and subdivision fencing to ensure efficient grazing management, the return is definitely economic and the practice allows accelerated development which is particularly important where large areas are involved.

We are also interested in aerial topdressing and this important method of pasture improvement may be used on certain blocks of our holding.

Stock Carrying Capacity

On the best blocks of the conventionally developed areas we run 3-4 ewes per acre and can provide all necessary hay from improved pastures. In addition, seed crops have been harvested with very satisfactory returns from particular fields. As mentioned earlier, the carrying capacity of the over-sown native or reverted swards, under topdressing and efficient grazing management, has been raised to 1-2 ewes per acre.

Appreciation

In the progress of our development programme we have been assisted by the technical help of officers of the Extension Division of the Department of Agriculture and Plant Diseases Division of the Department of Scientific and Industrial Research, as well as by farmers working similar types of country. While many new ideas regarding pre-treatment of old poorly producing swards before surface introduction of clovers are giving satisfactory results, we consider that further investigational work is essential. New and adapted types of equipment to ensure successful establishment of seed should be tried out and the clover seed inoculation project is not yet entirely satisfactory from the practical point of view. The work of molybdenum has resulted in marked improvement in clover and pasture production generally, and an important saving in sward maintenance with lower applications of lime was a really outstanding contribution. Efficiency in lime and fertiliser applications has been attained by the use of bulk-handling equipment which. is being operated extensively throughout the district. Similarly, in conventional development, reduction in seeding rates of pasture mixtures through the use of the roller drill has lowered cost of pasture establishment, while efficient insecticides have enabled control of pests which formerly necessitated resowing of formerly high-production swards.

Speaker: Mr K. W. REID

Area

The run, containing approximately 20,000 acres, extends from Harveys Flat (elevation 400-500 ft) to the high slopes of the Maungatua Range (3,000 ft).

Cliinate

The average annual rainfall of 28 in is normally fairly evenly distributed. Snowfalls are not usually dangerous, although last year 500 sheep were lost in snow. Freezing-up occurs in June and July.

Management and Development

In the early stages the only developed part of the holding was in Harveys Flat, which was used as the Romney stud nursery and also by young bulls and stock requiring special treatment. The remainder of the property was worked as a grazing run producing wool and store sheep. All stock were healthy, but towards the late 1930's marked reduction in carrying capacity became noticeable, the whole area then carrying about 6,000 sheep.

Since the various forms of development and pasture improvement were introduced sheep-carrying capacity and stock health have improved so that today we are shearing about 8,000 sheep and producing 60-70 additional bales of wool. In the last two seasons approximately 1,500 fat lambs, mainly off the mothers, were sent to works.

Approximately 140 Black Poll-Hereford cross cows are run. The cattle winter on the tussock blocks. The cows are mated on developed pastures, where they assist in controlling growth surplus to sheep requirements. Steers are kept to adult stage and many are fattened in favourable years.

We have found that the most difficult aspect of stock management with improved subdivided pastures and unimproved areas is the efficient utilisation of the hill country native swards by sheep which have spent their first two years on improved grassland. This results in lighter stocking of the tussock country involving extra. work in shepherding.

Housing and Labour

First-class housing has been erected for married and single workers.

Fencing

Subdivision to ensure effective utilisation of improved pastures has been carried out, but we estimate that about 100 miles of additional fencing will be required.

CRAIGLEA FARM LTD.

Speaker: Mr H. A. DUFF

This holding contains approximately 3,000 acres, of which about 2,000 acres are ploughable. It is typical of the country through which we have travelled for the last 5-6 miles and which until 3 years ago carried dense gorse and manuka. “Craiglea” is owned by a syndicate of which the main shareholders are Messrs Georgeson and Syme, who have asked me to describe their development programme.

Conventional methods have been followed, involving the working up of some 400 acres each year. Ploughing is completed as early as possible in autumn and the land winter disced and limed at 30 cwt per acre. Much of the success with swedes and pastures is due to the excellent cultivation before sowing. Of the area worked, about 60 acres are sown in swedes to be fed off on the ground. The remainder is sown in permanent pasture with a conventional mixture and at least 3 cwt per acre of molybdenised superphosphate plus D.D.T. for insect pest control.

In my paper to the conference yesterday full details of the development programme were supplied and you are now able to assess for yourselves the value of the improvements effected. These pastures and crops show just what can be done by men with faith in this country, the necessary “know how”, and the capital with which to develop modern techniques and management practices.

THORNTON AND JOHNSTONE

Speaker: Mr H. A. DUFF

The owners of this area of about 2,000 acres have asked me to describe the unusual development programme employed to secure the results now demonstrated. In two years, with the large crawler tractor and 10-ton roller, they have cleared the manuka from

1,200 acres. This was followed by burning, liming, and aerial sowing of pasture seed with fertiliser. I think you will agree that a really outstanding improvement has resulted. Full details were given in my paper yesterday and this trip has been arranged to enable conference members to inspect development areas where different methods of improvement are being employed. No doubt the subject of relative cost of development will be of interest, and while under the conventional system this will range from £22-£26 per acre as on "Craiglea", the outlay here will be approximately £10 per acre. In each case sheep-carrying capacity has been raised to over 1,000 and while both methods are undoubtedly successful, exact comparisons should not be made since so many factors are involved. The most interesting point on this holding is the rapid progress made with such relatively small capital expenditure, the necessary "know how", and hard work. Under efficient grazing management of sown pastures plus a small area conventionally sown in winter feed crop, the fertility build-up through stock will undoubtedly result in high-yielding crops and pastures in the second stage of the development programme

RANGELAND DEVELOPMENT FOR NEW ZEALAND

K. F. O'CONNOR, Liaison Officer, Department of Agriculture, Christchurch

At many previous conferences of the New Zealand Grassland Association papers have been presented on problems of tussock grassland improvement. 1 shall attempt today to outline not problems, but solutions. The problems are familiar to many. of- you; most of all they are real and familiar to those of you whose everyday life is, like mine, in the extensively used pastoral lands of the South Island,

The problems are in brief summary:

1. Low production from fine wool sheep.
2. Short span of palatable pasture production and generally very low levels of pasture growth from the modified tussock grassland..
3. Depletion of vegetation by fire and animals-sheep, rabbits, deer, opossums, thar, chamois, goats, and hares.
4. Erosion by wind, rain, and frost on the bared ground.
5. Floods in the valleys and lowlands of the catchments from heavy rain on the depleted and eroded slopes of the mountains,

These are the problems. Let us look at them for solutions, keeping an eye on the facts as they have been discovered by science and experience.,

Water from the Highlands

In New Zealand's short pastoral history water and not wool has been the most important and valuable product of the rangeland. Unfortunately for the community, and especially for lowland flood-plain farmers, this water has not been delivered in stable and well regulated quantities. Farmers here today from the Taieri and Balclutha areas know that only too well.

The most important single element in the regulation of water discharge from the highlands is vegetation. In primitive New Zealand the tussock grasslands and associated vegetation acted as one enormous sponge. The vegetation retained a great volume of water itself in its canopy and accumulated litter, and the soil had a highly developed capacity for taking in and storing water. Nowhere was this sponge character better developed than in tall danthonia tussock, whether red tussock on the plains and downlands or snowgrass on the mountains.

Where animal grazing, with or without land development, was introduced, the water regulating 'powers of vegetation have been reduced. Our concern should be not to make a living off a sponge, but rather make such a living that we can afford to live without the sponge. I suggest that this is what has happened on the tussock lands of lowland Southland. It has not happened on the tall tussock mountainlands of Otago, Southland, or Canterbury. There, animal grazing use of the snow tussock country at high altitudes has been unfortunately bought at such a high cost in loss of water regulation that not all the profits from summer sheep grazing or deer-shooting tourists are likely to pay for the costs of flood protection. To a less serious extent the same criticisms of wastefulness can be applied to the undeveloped and depleted short tussock grasslands of lower altitudes.

With these features in mind, it becomes clear that we could have safe grazing use on rangeland, even with rather high run-off and flood peaks, provided the land were developed so that its grazing use was economic for the nation. At present we have the high run-off and flood peaks without the high return from grazing use to pay for flood protection. We cannot expect to get production sufficient to pay for its costs on the high altitude snowgrass, but we can expect to get sufficient returns from the low and mid-altitude rangeland. We have, therefore, an added incentive for development of the lower altitudes and "throwing in the sponge" on the high-altitude land.

Control of Erosion by Rangeland Development

The most important single element in controlling erosion by falling rain or by wind is vegetative cover. It has' been shown experimentally that where vegetation provides more than 95 per cent cover of the soil surface erosion by wind or water is 'virtually prohibited. Complete cover is needed, with clovers, sward grasses, or tussocks equaly desirable from this point of view.' Virtually complete cover can be maintained under heavy stocking on highly developed rangeland pastures at low and medium altitudes under all except the driest conditions of Central Otago. This has been shown in runholders' experience as well as in experimental work. At low to medium altitudes, heavy stocking of pastures which have not been developed by manuring and oversowing leads to exposure of bare ground, frost movement, and subsequent erosion by wind and water. This has been shown in tussock grasslands throughout the South Island in the last 80 years, particularly when the pressure of rabbits made for heavy stocking even when sheep populations were comparatively low.

At higher altitudes, exposure of bare ground appears to be the almost inevitable consequence of animal introduction. It has been shown experimentally in Canterbury in the last year that snow-grass responds very adversely to severe defoliation and this would appear to explain the often observed serious effects of severe burning of snowgrass or of grazing after burning. It has so far proved impossible to establish sward grasslands with complete cover of the soil at high altitudes on all but very favoured sites. As a matter of interest, it has been very difficult to establish any grasses or legumes at all above 4,000 ft, let alone have them form a sward.

An additional influence of high altitude grasslands on erosion is seen in massive erosion caused by concentrated water movement, in gullies or in slumps and slides. This points to the need for building and maintaining not merely complete cover in the high altitude vegetation, but also a high interception and detention factor. This can be assured only by tall and dense vegetation with heavy litter accumulations. This cannot be obtained in the presence of grazing animals, and grazing animals cannot thrive under such vegetation conditions.

To conclude this aspect, therefore, we can see that full pastoral development is possible on low and medium altitude country and that this is necessary for protection against soil erosion if we are to have heavy stocking. Further, this developed rangeland must be protected against erosion influences from higher slopes by destocking the high altitude zones.

Fighting Depletion with Rangeland Revegetation

No form of rangeland development has made such rapid strides in experiment and practice in recent years as that of pasture development. It is impossible for me to review this in any detail here. Mr Lobb's paper reviews the same principles applied to the foothill country and in Mr Duff's paper and in this demonstration today you have examples of pasture development in the lowland rangeland zone.

There are three important features of the pasture improvement phase. They are:

1. Build fertility by adequate topdressing of the right kind and quantity.
2. Introduce plants that can utilise the higher fertility and can be used by animals.
3. Maintain the plant population and the built-up fertility by turning round the pasturage through the organic cycle of the grazing animal.

On the first of these features we can summarise the fertility needs of the short tussock areas in this way. Sulphur and nitrogen are needed by grasses and clovers for maximum growth. Sulphur must be added as fertiliser, preferably in both readily available form as superphosphate and in more slowly available form as elemental sulphur: Nitrogen is fixed in fairly satisfactory quantities by bacteria associated with welt-nodulated clovers, but the clovers themselves compete successfully with the grasses for both sulphur and the fixed nitrogen for quite some time unless fertiliser nitrogen is added. Phosphates are deficient in some but not all areas, and phosphate as fertiliser is apparently desirable for establishment of legumes in their early stages. In many areas phosphates may not be needed for maintenance for a long period. Trace elements such as molybdenum appear to be necessary for effective clover growth in many areas and it is good insurance to use molybdenum in districts where a deficiency is known to occur.

The amounts of fertiliser required are still the subject of research and considerable attention is now being given to this feature in the more than 400 trials which Department of Agriculture officers are conducting in rangeland areas. Very high clover production can be obtained from the addition of about 30 lb of sulphur per acre as sulphurised superphosphate, although there is some evidence that more than 60 lb of sulphur per acre can be taken up by clover pastures in a season, The frequency with which sulphur needs to be reapplied will be dependent on three factors in particular: the initial sulphur level of the top-dressed pasture, the net losses of sulphur from the pasture-soil complex, and the degree of immobilisation of sulphur which may occur. As a practical point it is reassuring to know that areas which have received only 12 lb of sulphur initially have had their clover rejuvenated by the addition of 12 lb of sulphur after a lapse of as long as five years.

Our experience with plant introduction is that high quality white clover is the legume of most universal value. Alsike and red clovers have been used successfully in many situations, while lucerne and subterranean clovers have been more prominent in drier areas. Of the grasses, cocksfoot has been the most generally successful, probably in part due to its ability to withstand low nitrogen conditions and to the profit from high nitrogen conditions. Grass introduction is likely to be quickly successful only where there is exposed or unstable soil, or where nitrogen levels have been built up by stocking of clovery pastures, or where the seed is introduced into the ground by mechanical means. Legume introduction by broadcasting is generally satisfactory, but in drier and more difficult areas establishment is accelerated by mechanical introduction.

Pasture Production in Developed Rangeland

Measured pasture production from ploughed and sown pastures at 2,350 ft in a 38 in rainfall zone in Canterbury has been as high as 8,000 lb of dry matter per acre without the addition of fertiliser nitrogen. Over several years the level of production has been about 6,000 lb per acre. With fertiliser nitrogen but without return of nutrient this level has been raised to nearly 12,000 lb of dry matter per acre. Production from the unmanured resident browntop, fescue tussock, and blue tussock sward has been approximately 600 lb per acre. This, therefore, represents an increase of from IO to 20 times the pasture production of the undeveloped rangeland. On more productive sites the increase in pasture production from oversowing and manuring alone can be estimated at from 4 to 10 times. These production levels from improved pastures have been reached in four or 'five months' of active growth. With appropriate grazing management this production can be utilised over a period of six or seven months without recourse to hay or silage making. By choosing sites that warm up early in the spring considerable extension of the grazing period of improved pastures can be secured. The grazing season can be extended too by the increase of grasses, especially those being sought for their wintergreen character and by the use of nitrogen fertiliser. This has already been applied on some runs, especially in Southland and the economics of the practice will depend not only on the cost of the fertiliser but on the value of the feed produced to the stock manager.

One feature that must be faced is that no matter how we may lengthen the season of pasture utilisation in the rangeland, we cannot greatly alter the stern climatic limits to plant growth, especially the limits of low temperatures. In contrast to the winter feeding problems, summer feeding on developed rangeland now presents no unsolved problems, except perhaps in the driest zone. When a runholder is faced with the difficulty of utilisation of improved pastures in the peak of summer production there can be little reason or justification for the continued grazing of high altitude snowgrass in pitiably unsafe and unproductive condition.

Animal Production from Developed Rangeland

This brings me to the final aspect, the problem of low production from fine wool sheep. The solution is essentially to use other kinds of flocks and herds. Flocks which at present have a high proportion of dry sheep with a fairly stable feed demand throughout the year are not suited to a pasture production system which has a strong seasonal peak. Sound principles of animal production would suggest that the flock should be changed so that its seasonal demand more closely matches the seasonal peak of pasture production. This is, of course, well illustrated in the fat lamb flocks of the North Island and of Southland. Some runs in the South Island with a substantial proportion of developed rangeland have now adapted their flock management to this pattern. In so doing they are not only getting better utilisation of their improved pastures, but they are also getting better and more varied production from their flocks.

In the final resort, if the appeal to some runholders, to be effective, must be an appeal not on behalf of the land, nor on behalf of their fellow-citizens downstream beside the flood-banks, then it can surely be an appeal on behalf of their flocks and pocketbooks. In this respect the opportunities for rangeland development at present before Otago and Southland are the first chance that many sheep have had to have a good feed without walking yards between bites. I doubt if anyone will find one runholder who has followed out these practices of rangeland development thoroughly who is not more confident and more proud of his land and his flock as a result.

INVERMAY RESEARCH STATION

PADDOCK SCALE COMPARISON OF THREE PASTURE MIXTURES

K. H. C. LEWIS, Research Officer, Invermay Research Station

OBJECTS: To compare the production and sward composition of a low ryegrass mixture and a timothy-cocksfoot dominant mixture with that of a standard high seeding rate mixture.

To investigate stock thrift of such swards, especially lamb fattening.

Two paddocks of each of the following mixtures were sown in two replicates.

High ryegrass	*Low ryegrass*	*No ryegrass*
20 perennial	5 perennial	5 cocksfoot
10 short-rotation	3 short-rotation	5 timothy
5 cocksfoot	4 cocksfoot	2 Mont. clover
3 timothy	2 timothy	2 sub. clover
2 Mont. red clover	2 Mont. red clover	2 white clover
2 red clover	2 red clover	
3 white clover	2 white clover	

Broadcast with 2 cwt DDT super and sown 8.3.58.

Establishment was good, the high rate being denser than the low, "No ryegrass" was slower to establish with timothy prominent.

During early winter the high rate grew vigorously, short-rotation in particular. The low rate was healthy but less dense. The "No ryegrass" treatment made slower growth, dominantly timothy, although clover was much more in evidence.

By mid-winter the production from the high rate was twice that of the low rate and that from timothy negligible. In early spring, however, the growth rate of both the low rate and timothy increased relative to the high rate and by late spring was 50- 75 per cent greater.

Total production from establishment until November is now equal and expectation is for continued higher production on the low rate and timothy treatments.

Pasture composition in spring showed only 3 per cent sown species other than ryegrass in the high rate, and 11 per cent in the low rate.

After a period of grazing to uniform level, a lamb production trial was established in late September. The area was stocked uniformly with 2 tooth ewes with single down-cross lambs approximately 6 weeks of age at foot. The rate of stocking was 7 ewes per acre.

Feed on all treatments was maintained at a similar level by the intermittent use of dry sheep.

Growth rate of lambs at fortnightly intervals is as follows:

	High rate	Low rate	No ryegrass
	lb	lb	lb
Initial wt.	25.0	23.7	23.1
gain to 7.10.58	10.2	9.7	9.9
21.10.58	6.5	7.9	7.2
5.11.58	9.5	9.8	10.2
Total gain	26.2	27.4	27.3
Gain per day	.61	.64	.64

Lamb growth has been exceptionally good without significant differences developing between treatments.

After weaning and drafting experimental grazing will continue with weaned lambs.

THE EFFECT OF PLOUGHING ON RESPONSES TO FERTILISERS

R. S. SCOTT, Research Officer, Invermay Research Station

Although this trial is of great interest because of the inclusion of a chemically sprayed and oversown treatment, it was primarily designed to study the fate of the top fertility-rich layer of soil after ploughing a pasture. Accordingly, the following main block treatments were compared, each replicated- three times.

1. Leaving the top fertility layer in situ by killing the existing sward seven weeks before oversowing.
2. Skim ploughing in mid October to a depth of 4 in.
3. Deep ploughing in mid October to a depth of 8 in.

These latter two treatments were broadcast at the same time (end of February) as the chemically treated sward. Cultivation was performed with the normal type of farm implement-discs, grubber, harrow, and roller.

Another main block treatment-the original sward-was included to allow a comparison of the old and new pasture. With improved pasture fertility and management on this class of country there are many pastures ploughed, not because of their lack of production or poor composition, but solely because they come next in the rotation. The inclusion of this treatment should provide interesting information on this subject.

Within each main block treatment, fertiliser sub-treatments were applied to give more' precise information on the nitrogen and phosphate status of the main treatments. Nitrolime was applied at 0 and 2 cwt/acre and double super at 0, 1½, and 3 cwtjacre. Each was applied alone and in combination.

At the time of sowing the cultivated blocks had a firm, fine, and moist seed bed ideal for good establishment. The chemically treated blocks were devoid of vegetation and had very little dead litter present. In a normal season sowing at this time would have given good autumn establishment. In this trial adverse weather conditions were experienced following sowing and resulted in very slow establishment, particularly in the chemically treated blocks. It was not until spring of this year that sufficient growth was present to permit mowing and yield determination.

In June, three months after sowing, point analysis showed a considerablly higher percentage of annual poa in chemically treated blocks than in ploughed blocks. All main treatments had a low clover percentage at this stage-2 per cent in the chemical treatment, 9 per cent in the deep ploughing, and 6 per cent in the skim ploughing. Also slightly lower percentages of ryegrass and timothy were present in chemically treated blocks.

In early spring good establishment of pastures became evident, although it was slower on the chemically treated blocks. All suffered from a low clover percentage, particularly the chemical treatment. This was shown in the herbage dissection on the first cut taken in early September; deep ploughing showed a range of

3-10 per cent clover, skim ploughing 2-7 per cent, and chemically treated l-2 per cent.

Yield results of the two cuts taken to date (early September and mid October) both followed a similar pattern. In all the sub-plots, skim ploughing gave the highest yields followed by deep ploughing, while chemically treated was lowest yielding, probably a reflection of the slower establishment.

There was only a slight nitrogen response on the deep ploughing treatment and this could be interpreted as a sign of a high nitrogen status. The chemically treated blocks gave a larger nitrogen response than skim ploughing, again suggesting a higher nitrogen status after ploughing. It could well be that the fallow period allowed a breakdown of organic matter and release of available nitrogen more rapidly than the chemical treatment.

Chemically treated blocks gave the largest phosphate response followed by skim ploughed blocks, while deep ploughing did not appear to give any response. The greatest part of these increases in yield was from the grasses.

These results are only interim and have not yet been subjected to statistical analysis. However, it appears that interesting information will be obtained on the question of how deep to plough and what fertiliser to apply, together with an evaluation of the merits of renewing an old-established but thrifty pasture. Also some information should be gained on the fertiliser requirements for pasture establishment on chemically treated swards.

RATES OF MOLYBDENUM TRIAL

R. S. SCOTT, Research Officer, Invermay Research Station

This trial was designed to give more detailed information on the molybdenum responses first recorded at the Station in 1950. In view of the North Island reports at the time on the adverse effects on stock health resulting from heavy applications of molybdenum to pasture, the trial was designed to indicate the minimum rate of molybdenum necessary to allow maximum pasture responses. Accordingly sodium molybdate was applied in solution at rates ranging from 1/32 to 2 oz/acre. In spring 1956, four years after the initial application, plots were split in two and half were chosen at random and retreated with sodium molybdate at the original rates. Yield data were obtained by the mowing-and-clippings-return technique.

A run-out brown-top dominant sward typical of the second class country of much of Otago and Southland was chosen. A small percentage of red and white clover was present, exhibiting typical molybdenum deficiency symptoms, Also present in the sward were traces of grasses such as dogstail, sweet vernal, cocksfoot, and perennial ryegrass.

An initial soil test of the top 3 in of the area revealed pH 5.7, Ca 5 parts per 20,000, and P 1.8 parts per 50,000,000. When the trial was laid down the area was oversown with Montgomery and white clover together with 10 cwt of lime/acre, 3 cwt of serpentine superphosphate/acre, and 1 cwt of muriate of potash/acre. Subsequent dressings of superphosphate and potash were applied annually.

The effect of the lime dressings was to raise the pH to 6.3 in the top inch and to 5.7 at 2-3 in. Since that time there has been a steady decline and at present the pH is 5.6. Lime does not appear to have improved the control plots to any marked extent, as can be seen from both the yield data and the unthrifty nature of the clovers present in these plots.

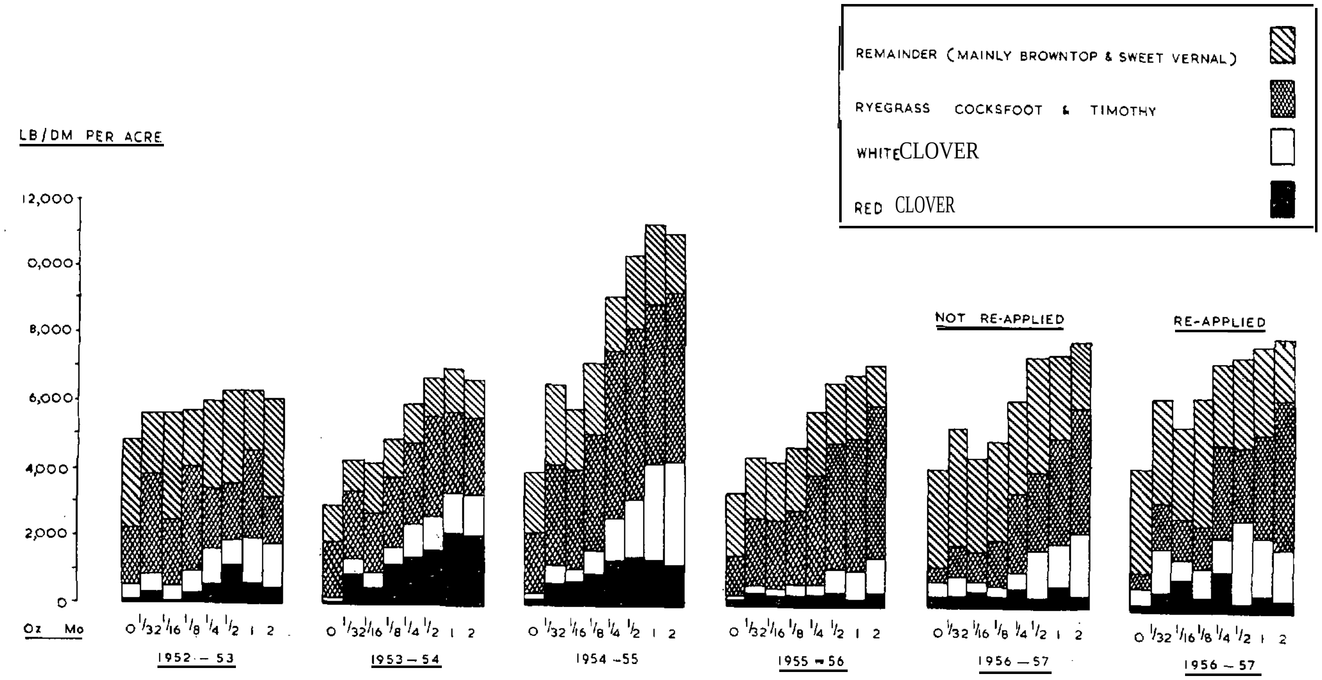
Changes in sward composition following the application of molybdenum are of interest. First to respond were the clovers, particularly red clover. This first became evident two months after application on all except the control and 1/32 oz plots. In the second season the percentage of clovers continued to increase, particularly at the heavier rates of application, and by comparison with the subsequent season the percentage clover in the sward appears to have reached an equilibrium in the second season. The low percentage of clovers recorded in the fourth season is largely attributable to the extremely dry summer as indicated by the poor growth of red clover. Analyses of total species yields for the sixth season have not yet been completed.

It will be noted that the build-up of perennial ryegrass, cocksfoot, and timothy was rather slow, but this is not surprising, since it resulted from plants present before commencement of the trial and also was dependent on the release of nitrogen from the clovers.

From the histogram it can be seen that the percentage response reached a maximum in the third season. The fall in reponse in the fourth year was largely due to the dry summer.

Results from individual treatments show a good response from the lowest rate (1/32 oz). Maximum responses occurred at the 1 oz rate, and although appearing higher yielding than the 2 oz rate, the difference was not significant.

The effect of a repeat application of molybdenum to half of each plot in spring 1956 was to give responses which for the season reached a peak at the $\frac{1}{8}$ oz rate and fell off as the rate increased beyond this rate. Statistical analysis allowing for plot uniformity showed a significant response to re-application up to



Rates of Molybdenum Application.

1 oz/acre in the summer when the growth was at a maximum. Most of this response appeared to be due to increased yields of white clover,

Recommendations arising from this trial are to apply molybdenum every four years at a maximum rate of 1-2 oz/acre.

CHEMICAL AIDS TO PASTURE RENOVATION

F. A. MEEKLAH, Technician, lnvermay Research Station

Considerable interest has been aroused in New Zealand by the revolutionary technique of using grass-killing chemicals to destroy the existing turf and so facilitate the introduction of more desirable species. The particular facet of this technique that has possibly the greatest interest in Otago and Southland is the possible application to the improvement of low fertility browntop dominant swards. All trials consequently have been laid down on browntop swards, and volume rates and methods of oversowing have generally been employed with aerial application in mind.

So far we have confirmed North Island work in that an application of 5 lb of dalapon and 1 lb amitrol is generally adequate for the control of the species found in association with a browntop dominant sward, that is, chewings fescue, dogstail, flatweeds, and poor strains of white clover. The interval between spraying and sowing is still being studied, but work to date has shown that this interval is not critical: one can oversow as soon as one likes after spraying, probably the sooner the better providing rain has not washed the herbicides into the soil, thus creating risk of absorption by seedling roots.

There are indications that early autumn oversowing is not very satisfactory, and we favour early spring sowings at the moment, but have little experimental data to support this belief.

So far we have had little success with this chemical turf destruction and oversowing at Invermay : but we are slowly learning more about it and hope that in a few years' time we may have a great deal more information. At the moment the technique as used in the North Island appears to be too susceptible, in the South Island, to the vagaries of the weather and ground conditions. For example, we record a better initial establishment of oversown species when the cover. is short. This is unfortunate, because seedlings in these areas are liable to suffer desiccation due to lack of protective cover. Where cover is long we find that seedling establshment is very poor. In addition these seedlings have to contend with competition from regrowth of original species. To obtain a better kill where cover is long, the volume of application would have to be considerably in excess of the 20 gals/acre used as a standard volume rate in these trials.

Soil fertility appears to play an important part in affecting the vigour of establishing species: whereas with normal cultivation methods a satisfactory pasture can be established with a few cwt of super plus trace elements, with this technique severe nitrogen deficiency is evident in any seedlings that may establish and dressings of nitrogenous fertilisers are called for ,together with heavier than normal applications of superphosphate.

In the trial demonstrated two methods of introducing seed had been compared, broadcasting and drilling. The establishment of species was not particularly successful, possible reasons for this failure being that oversowing was carried out in March, and this date was rather late in the particular season, due to the onset of a cold, wet autumn, with similar conditions in the early winter: thus seedling mortality was severe, though it must be emphasised that even before adverse weather occurred the establishment could hardly be called satisfactory.

Drilling was carried out with a 13-coulter disc drill, but penetration was poor, a factor noted in previous trials. Penetration was better where the turf kill was very good as in the dalapon + amitrol plots; even here the discs opened up only a slight groove on the surface, but this permitted the seed to come into direct contact with the soil. Seedling establishment was very slow and did not appear promising until the onset of warmer conditions this spring. It is in this sphere that the method appears to hold most promise at the moment; that is, to aid the establishment of desirable species by methods of over-drilling. As far as broadcasting is concerned we may eventually come to the conclusion that the method is likely to be unpredictable, except in districts of heavy rainfall and high humidity.

Three cwt of nitrolime was applied this spring to a portion of' all plots in the trial demonstrated. This has helped oversown species to become firmly established and to tiller well; unfortunately it has given a large boost to the regeneration of browntop and associated species which have come in.

It was also reported that throughout the series of trials in progress, inoculation of clovers is standard practice; a heavy seeding rate of 35 lb/acre is employed, and a dressing of 3-4 cwt of molybdenised superphosphate is given at the time 'of oversowing, with maintenance applications in the spring where necessary. The use of lime to correct soil acidity in an effort to improve seedling establishment is also under investigation.

IMPROVEMENTS OF BROWNTOP BY OVERSOWING AND TOPDRESSING

N. A. CULLEN, Research Officer, Invermay Research Station

Details of a trial laid down in 1953 were given as follows:

An old run-out browntop pasture was selected and divided into 3 one-acre paddocks. These were treated as follows:

Paddock 1: Ploughed July 1953 and sown to new pasture in December of that year after receiving 30 cwt of lime. The new pasture was sown with 290 lb of superphosphate and received a further 2 cwt of molybdenised superphosphate 4 months later. Thereafter the paddock received 3 cwt of superphosphate annually.

Paddock 2: Oversown with 3 lb of N.Z. Cert. white clover and 3 lb of Montgomery red clover and topdressed with 30 cwt of lime and 2 cwt of molybdenised superphosphate in September 1953. A further 2 cwt of superphosphate was topdressed in April 1956. As in paddock 1, the paddock has since been topdressed annually.

Paddock 3: Left in its natural state as a control.

Results

The results from oversowing and topdressing were spectacular. Within a few weeks an improvement was visible and by the end of the first season the clover percentage had risen from about 5 per cent to about 30 per cent. Production rose in proportion and in the second and subsequent seasons production from this rejuvenated pasture has been comparable with that from new grass. Establishment in the new pasture paddock was good and at no time since sowing has the ingress of weed grasses been serious.

In each of the four seasons to date the yields from the control, plot have been much inferior to the other two (see table of yields).

Yields D.M. lb/acre

Treatment	1954-55	1955-56	1956-57	1957-58	Total
1. New Grass	6,850	6,700	12,100	12,450	'38,100
2. Oversown & topdressed	6,900	7,400	11,050	12,050	37,400
3. Control	1,700	1,350	2,600	5,100	10,750

These figures indicate that over the 4 year period the oversown. and topdressed paddock has compared very favourably in yield with the paddocks sown to new grass. Both have given nearly four times the production of the untreated browntop control. In this investigation the renovation of the browntop without recourse to ploughing and resowing proved very promising, especially as costs were less than half of the ploughing and resowing method.

Pasture Establishment Trials

Results of trials investigating rates of seeding were described by Mr Cullen during an inspection of various projects on the alluvial flat land. These trials demonstrated that on the high fertility soils the inclusion of high rates of ryegrass was undesirable because of the severe suppression effects of this species on the slower growing grasses and clovers.

The question of sowing rape with new pasture was discussed and a trial shown which demonstrated clearly the disadvantages of the heavy 2 lb seeding of rape. In this treatment the sward was extremely thin and the ground almost bare in patches while the no rape treatment had a good dense cover.

In this trial plots sown with a 20 lb seed mixture compared very favourably with a 40 lb mixture, especially in the no rape plots.

A trial with three pasture mixtures sown on a paddock scale in February 1958 was also described and the sward of each paddock inspected. At present little difference can be seen by eye between the 20 lb and 4.5 lb mixtures, while yield measurements show the production to be comparable. A timothy-dominant mixture sown without ryegrass appears very promising at present and is comparable in production with the 45 mixture. In this trial, pasture production, composition, and lamb thrift are under investigation.