TUSSOCK GRASSLANDS AND MOUNTAIN LANDS INSTITUTE

REVIEW

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THE ECONOMICS OF DEVELOPMENT

A STUDY OF ONE HILL-COUNTRY FARM

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New Zealand needs an increase of four per cent yearly in pastoral production to maintain economic stability and growth. This sounds reasonable in percentage terms but is rather more fearsome if thought of as extra pounds of meat and wool. Such an increase means an *extra* 500 million pounds of greasy wool alone to market in ten years' time! Where is this increased production to come from? The most popular answer in policy-making circles is that New Zealand must look to its hill country. This is no doubt true but two questions spring at once to mind.

First, is this sort of production increase practically possible?

Second, is it profitable to the farmer?

To give a partial answer to these questions, I intend, in this article, to discuss the results of a hill farm development programme which has been carried out in Marlborough. The property was chosen for this study because of the very high proportion of development expenditure which has gone into seed and fertiliser.

The Property

The farm has been owned since 1942 by Mr E. Scherp who has this year sold to his son, Mr R. Scherp.

It is near Hillersden in Marlborough 30 miles up the Wairau valley from Blenheim.

It is almost a complete small catchment, long (five miles) and narrow (half-mile average width) lying north-south so that there is a good balance between sunny and dark faces.

Fifteen hundred acres of steep hills lie on either side of a narrow stream which widens at the bottom to some 190 acres of stony, broken flats much of which can be cultivated.

Total area—1,740 acres.

Altitude—700 feet to 3.400 feet.

Climate—40 inch rainfall. Hot dry summers.

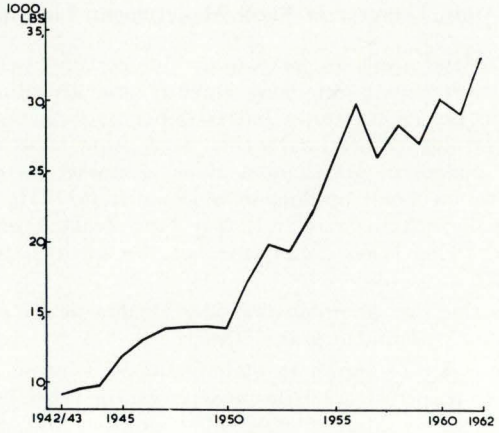
Hill Soil Type—mainly Haldon steepland and Hurunui steepland.

Vegetation—was mainly silver tussock, browntop, sweet vernal and danthonia with fern, manuka, matagouri and tutu (the last-named since killed by spraying), but now with an increasing amount of clover, cocksfoot and other useful grasses.

The farm was regarded in the district as quite a good place when taken over in 1942.

Stock Production Increase		Sheep	Wool	Cattle
Bought - - -	1942	1,172	9,272	0
Development started -	1949/50	1,500	13,973	0
Latest figures - -	1962/63	2,900	33,000	190

Thus, wool production alone in the last 13 years has risen 7 per cent per annum. The first question has been answered—a production increase of better than 4 per cent per annum is possible on this type of hill country.



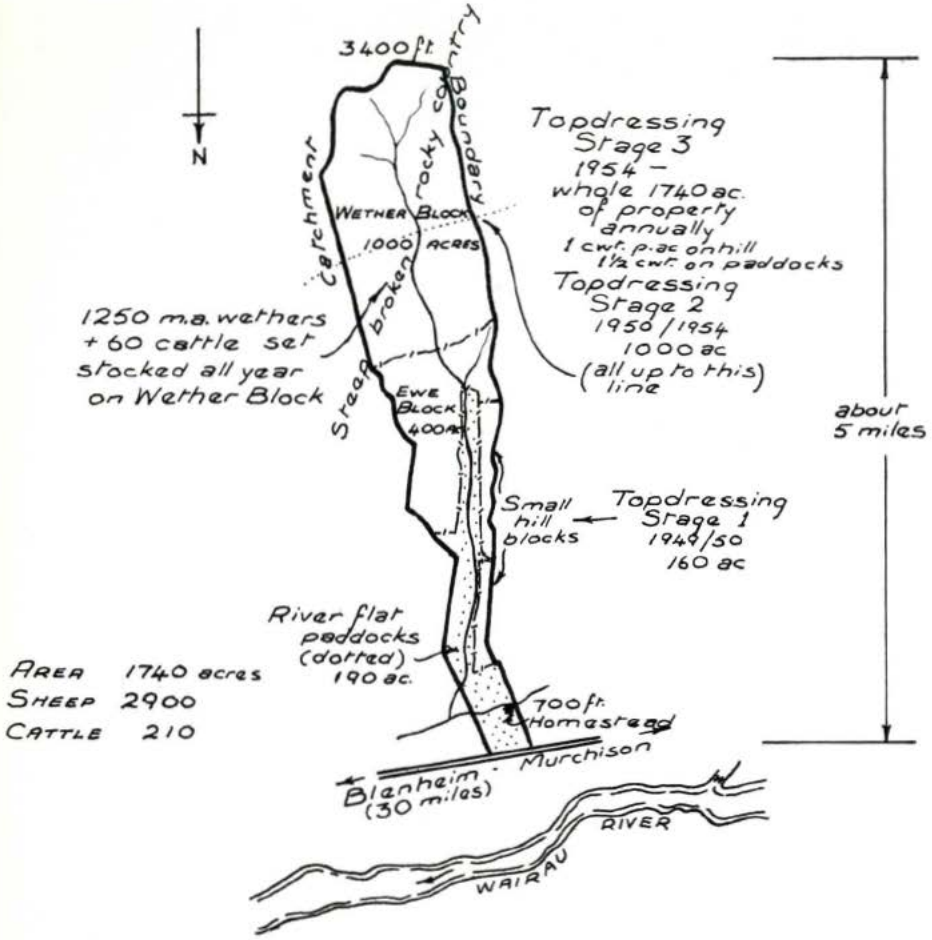
WOOL PRODUCTION

Let us now consider whether this dramatic increase of 135 per cent in wool production in 13 years was economically profitable, either for Mr Scherp or for the nation. One does not necessarily follow the other.

The Results and Economic Theory.

a. Time and Interest.

Over 13 years of development, Mr Scherp has reinvested some £30,000 of income as capital in the property instead of investing it elsewhere. Thus he has foregone the use of that money and for this he must be paid interest. The economist, in allowing for this in his figuring, is taking note of the saying "a bird in the hand is worth two in the bush"; in other words most people would rather have had a pound in the hand in 1948/49 than wait until 1960/61—13 years later. That is, in order to get people to forego some amount of income in 1948/49 and postpone its use until 1960/61 involves a cost; and this "cost of time" is the interest or discount rate. Most people are familiar with the idea of compound interest. This means that if £1 was invested at some given rate of compound interest in 1955 and each year's interest was also reinvested, that £1 would be worth, say, £1 10s. in 1960. Thus, if we want to calculate the 1960 value of some expenditure made in 1955 we take the original cost and add "compound interest" at some given rate. Conversely if we want to go back to the 1955 value of a 1960 cost then



we take that 1960 cost and reduce it by a given interest rate, or "discount" rate. The process is called "discounting."

b. The Effect of Inflation.

Over a period of years the prices of farm inputs and outputs change and we are faced with inflation. Thus, besides the cost of persuading people to postpone spending on themselves rather than on the farm, we must make some allowance for the change in the real worth of the pound. Under inflation the pound has less and less purchasing power each year. The economists' way of handling this is to artificially deflate *money* values to *real* values by converting all costs and prices to a similar level at some chosen date. In Mr Scherp's case this chosen date is the 1959/60 year when the market prices for both wool and meat, and for

farm inputs were at a reasonably "normal" level—neither too high nor too low. It was a fair average year.

c. Economic Benefits from a Development Programme.

These are in two forms:

(i) the *income effect* or rise in income year year

(ii) the *capital gains effect* or increase in the value of property, livestock and plant.

HOW THE PROFITABILITY OF THIS FARM WAS CALCULATED

The Computation of the "Income Effect."

The actual method of working out the profitability for this farm is fairly complicated since both time and inflation effects must be taken into account. Suffice to say that from each year's additional costs and increased returns due to development, a series of year-by-year increases in net income figures was compiled. Each of these was then discounted back to the starting date of development. In other words, if an increase in income of, say, £3,000 was made in 1955, then by a "reverse-compound-interest" calculation some rate of interest was found which would bring the actual 1955 figure back to its worth in the starting year, 1948. The average of all these interest rates was then found. In the case of this property it was 64 per cent.

What this shows is that if Mr Scherp has borrowed the required £30,000 in 1948/49, at an interest rate of 64 per cent, and if he had spent this capital sum on exactly the same programme over 13 years that he financed instead by re-investing out of income, then he would just have broken even at the end of this time. The figure of 64 per cent is therefore the previously mentioned "income effect" of the rise in financial returns brought about by the programme. Put another way, there was broadly speaking an average return of 64 per cent in the form of extra income on the money reinvested in the development programme. This assumes that all the extra income earned each year was immediately ploughed back into the farm instead of being used for higher personal drawings.

The Effect of the Wool Boom on Income

Now 64 per cent will seem to be a very high figure, and it is, but it must be remembered that this result was heavily influenced by the wool boom in 1950/51. This wool boom had the effect solely of increasing the prices paid for the property's wool and sale sheep—it had nothing to do with any physical increase of production. Thus the picture of the financial gains due to the development programme was made much more rosy by a factor which was quite fortuitous. This large "windfall gain" was strictly a financial effect and was not due to a corresponding increase in production from the farm. Nevertheless, it had a most important result. By "freezing" most of the extra income in the boom year, Mr Scherp was able to continue his rate of development by spreading its spending over the next four years.

If, however, we now adjust the calculations to take out this wool boom effect from the annual additional net incomes, then the interest rate for the period is reduced from 64 per cent to 39 per cent.

Capital Gains

I have already pointed out that the financial returns due to development can be measured both as an increase in income and as an increase in capital or "capital gain."

If we do a further set of calculations to establish the combined interest rate theoretically earned by the extra income and the mounting capital gain when discounted back to the starting year, we find the total result of Mr Scherp's development is again a 64 per cent interest rate.

Why should this be so? It would seem on the face of it that *all* of the high interest rate was due to the extra income earned annually, and none to the increased capital value of the property.

In the simplest possible terms it can be likened to £1 of mine going through a racing totalisator. What happened at the "tote" is that every time that £1 is invested on the "tote" the Government takes a percentage of this £1 in the form of racing tax. That is, the Government racing tax is the cost of betting. This Government tax "rake-off" is a continuous process on this continually re-invested £1, so that by the time any £1 has been through the "tote" several times, the Government has collected the full £1 as racing tax, and the original £1 has been transferred from my pocket to the coffers of the State.

Similarly, in the case of the farmer engaged in development, the large capital gain (the £1 of the "tote" example) which he appears to have made at the end of the development period (or the extra sale value of his property) becomes, when it is discounted back to the start, transferred in part to the "cost of time." That is, some of this capital gain is siphoned off by the discount rate (the racing tax) as payment to "time" rather than as real gain to the farmer. Thus, if the property was worth, say, £10,000 in the first year of development and £30,000 in the last, then the increase of £20,000 is only in fact, equal to the compound interest over thirteen years on the original £10,000.

Just as an increase in the rate of tax makes the punter's pound disappear faster so an increased discount rate (i.e. a higher cost of time) makes the individual farmer's capital gain disappear faster. What this means is that at high rates of discount (in this case 64 per cent)—or a high cost for time—it takes an enormous capital gain at the end, greater even that that on this property, to be of any significant benefit to the farmer in terms of extra purchasing power.

Inflation

Up to this point I have been talking solely in terms of *money values*. We have noted the effect of the wool boom as a market-price fluctuation but so far ignored the effect of inflation. What we should be interested in are *real values* (or real purchasing power) with all the money values converted to some base year by taking out the effect of inflation, or the decrease in real value of currency year by year.

As stated before, for this study we converted all the costs and

returns of Mr Scherp's property to their value in the season of 1959/60. The effects of both wool boom and inflation were set aside. A completely different picture of the profitability emerged. At the 1959/60 values, the income effect gave an average interest return of almost exactly 0 per cent! In other words, the re-invested income earned no extra real *income* at all. At these values, the income effect has just kept up with the rate of inflation. Thus, the development plan had paid back the capital which had been put into it but there was no margin for the paying of interest on that capital. (Remember in money terms it had seemed to be 64 per cent). That is, the wool boom effect accounted for one third of the 64 per cent interest return and inflation obviously accounted for the remaining two thirds.

As an example to illustrate the result, if Mr Scherp had had a lump-sum Marginal Lands loan at the start, in *real value terms* he would have been able to repay the capital amount but would have had to defer payment of interest for the whole 13-year term. In money terms of course he would have been able easily to pay it.

If, however, the capital-gain effect was once more added to this income effect (as was done previously in money terms, you will remember, to again get 64 per cent), the combined effect did produce an interest rate in real terms of 6 per cent. Thus the addition of the capital-gain effect—the increase in value of the property—means that all the invested capital has been repaid and besides this an interest rate of 6 per cent could have been paid on the money.

Therefore to put the financial results of this development programme in their true perspective:

In money terms—Mr Scherp's development has been profitable, with due allowance for time included. The rate of interest return has been 64 per cent.

In real terms—that is with inflation taken into account and all money values converted to their value in one fair average year, Mr Scherp's development has been only barely profitable. In fact, over a 13-year period, *and at 1959/60 values* it is only the increased capital gains effect showing an interest return of 6 per cent which has made it profitable at all.

The Realisation on a Capital Gain

Since the extra income has been re-invested and the biggest return is in the capital-gain effect, then the increase in value realised at sale (or increased security value for a mortgage) has been the only real gain to the owner for carrying out the programme.

Profitability to the Nation

In the long term a nation benefits mainly from rises in real income —that is, increases in income resulting from increases in production. Rises in the prices of products may add some extra cream to the "national cake" but these price rises tend to be transitory and fickle. Thus, the nation is mainly interested in productivity. All that inflation does is to camouflage the true situation.

Moreover the nation is not interested in capital gains to Mr Scherp. They are a private matter and of no direct benefit to the national economy. From the nation's point of view therefore, Mr Scherp's development may not, in real or 1959/60 values, have been truly profitable to it over the 13-year period. That is, the interest rate on additional income at real values was 0 per cent. In terms of the future, however, Mr Scherp's development has been worthwhile to the nation, because all other things being equal, it can continue to cash in on his increased productivity. Even if export prices should fall in the future, then the nation is in a better position now than it was before Mr Scherp started to develop. Whether the nation would have been even better off by putting Mr Scherp's £30,000 into some other avenue of investment, remains as yet unanswered. The fact of the matter is, however, that New Zealand's secondary industry is based to a considerable extent on imported raw materials. As our secondary industry expands and demands more imports, the economic future of New Zealand becomes increasingly dependent on increased agricultural production. In these terms, Mr Scherp has done a good job for New Zealand.

Adjustments

It should be stated that all this analysis has been based on *before-tax* levels of income. In fact, adequate allowance has been made for tax on the costs side by making full "wages of management" payable to Mr Scherp. These would cover both his personal drawings and tax bill. If after-tax income had been used instead, therefore, the results would probably have been little different. It must be noted, however, that where development has been financed out of borrowed capital rather than out of income, then tax can significantly alter the picture.

Discussion of the Programme

We have discussed so far only the broad financial results of the programme, which it must be emphasised are only applicable to one individual farm and farmer, and must not be extended from the particular to the general case. This analysis of Mr Scherp's farm has been a study of history on an individual farm basis, but it does perhaps point some guidelines to the future.

First, the economic profitability of any development programme is closely correlated with the existing economic environment. Thus where Mr Scherp's programme has been shown under 1959/60 values to be barely profitable, then under 1963/64 conditions where the wool price has risen by 15 per cent and costs have only risen by 4 per cent, this programme could be expected to be significantly more profitable. For a farmer contemplating future development therefore, the projected level of future costs and prices is of fundamental importance. Second, it must be emphasised that the rate or speed of development is of great significance in the determination of profitability. In Mr Scherp's case, had he been able to compress his development into six or seven years, then his profitability would have increased significantly. Unfortunately there is no general answer to the question of rate of development, and each

case must be studied individually. The only point that can be emphasised is that when comparing development plans of different lengths, due allowance must be made for time, and the correct method to apply is that of discounting. The third point to be noted is the farmer's situation in the face of falling prices, once the development programme has been completed. Where the development has been done out of income, then the farmer is normally farming a more economically stable unit, and can withstand a more violent fall in product prices than the farmer who has developed out of borrowed capital. Thus development out of income tends to be the less risky method of development.

In the preceding discussion emphasis has been laid on the economic considerations of Mr Scherp's development, but some points of a more practical nature can be deduced from this programme. Basically, the story of this farm is the story of the impact of aerial topdressing and oversowing on hill country. A measure of the dominance of these techniques is the fact that lime, fertiliser and seeds account for 90 per cent (£25,000) of the total additional capital invested (£30,000) apart from extra stock. The other interesting feature of the pattern of costs is the very small amount of money spent on extra fencing and subdivision. This is mainly the result of the emphasis placed on the topdressing of the farm, and would certainly not be applicable to the general run of hill country farms undergoing development. In terms of superphosphate application, the farm by 1960/61 had received over 12cwt per acre. Although Mr Scherp is convinced that the returns from topdressing are greater than from fencing at the present stage, the interesting question posed is: Is this really correct? Further, what would the effect be if the 12cwt of super per acre had been applied in half the time? In other words is it feasible to recommend higher initial rates of topdressing and to expect equivalent or better returns than those obtained under Mr Scherp's method? As yet there is no definite answer to this, but evidence is accumulating to suggest that high initial rates are to be recommended on many of the New Zealand hill soils. The most spectacular demonstration of this is the result at Te Awa in the North Island where a topdressing programme of 6cwt of super in each of two years followed by maintenance topdressing of 2cwt of super per year lifted carrying capacity from three ewes to six ewes in three years. One thing is certain, that if this technique of high initial rates can be shown to give guaranteed results, then a compression of development programmes may be possible and the profitability of hill country development should increase.

The Pattern of Output Compared with Other Farms

Interesting as the pattern of inputs may be, the pattern of production or output is even more interesting. From figures published by the New Zealand Meat and Wool Boards' Economic Service* it would appear that the ratio of wool to sheep meat for the following three

*"Financial Analysis of New Zealand Sheep Farms" by Keen and Gow.

classes of New Zealand sheep farms is:

South Island High Country, 1lb wool : 1lb sheep meat.

North Island Hard Hill Country, 1lb wool : 1.5lb sheep meat.

South Island Hill Country, 1lb wool : 2lb sheep meat.

Mr Scherp's ratio is 1lb wool : 1.3lb of sheep meat. If we accept the view that the outlook for wool is better than that for meat in the foreseeable future, then Mr Scherp's pattern of production, where wool producion is emphasised, may well foreshadow the desirable pattern for the future.

Features of the Management

How has this pattern of production been achieved? In the first place, the flock consists of the maximum number of wethers and a minimum number of ewes. In fact there are only about 900 ewes in a total flock of over 3,000 sheep. In addition cull two-tooths not required for breeding purposes are sometimes run as dry sheep. The answer to the small number of ewes is bound up in two factors.

First, the area of flat land is used to maximum efficiency by running old ewes on it and getting a high lambing percentage from them (120 per cent). This means that only a bare minimum of ewes has to be kept to provide a suitable number of flock replacements. In addition, overall stock efficiency is increased by an extremely low death rate. Maximum production from the ewes, and a high level of overall stock efficiency have resulted in the number of ewes (28 per cent of the flock) needed to maintain the flock being reduced below the figure normally accepted as being the minimum desirable level (30 per cent of the flock).

The other interesting feature of the pattern of production is the influence of the cattle. These are bought-in as calves in April-May and wintered on the paddocks with some hay before being turned on to the hills in the spring. There they stay for one to two years until fat or nearly fat, according to the block and the seasons. Although the cattle have undoubtedly played a part in the development story, it is a moot point whether or not they should have been replaced by more wethers. If more wethers had been put on, then more subdivision would have been necessary. Further, sheep numbers were being built up at the maximum possible rate and thus any additional sheep would have had to have been bought-in. This policy, as always, would have introduced the risk of footrot, and this factor could not be lightly set aside. In 1955/56 Mr Scherp faced a serious problem of footrot when a considerable proportion of his flock became infected. The tremendous flush of sub-clover produced by the oversowing and topdressing programme, and the long narrow shape of the farm which made isolation techniques difficult, resulted in some 350 man-hours being spent in eradicating the footrot outbreak. Thus it would be misleading to think that this success story of farm development has not had its moments from a managerial point of view.

Summary

1. There is a considerable amount of South Island hill country still

carrying about one ewe-equivalent per acre. This is about the level that Mr Scherp was maintaining in the early 1950's. Since then of course he has lifted his carrying capacity up to nearly two ewe-equivalents per acre. In addition he has obtained an annual increase of 7 per cent in his wool production. Thus a 4 per cent increase in production would seem to be a practical proposition for a considerable amount of our hill country, provided the physical and economic climate is reasonable.

2. Development of land is still in many cases an act of faith because very little work has ben done on the economics of development. Fortunately this gap in our knowledge has been recognised and steps are being taken to rectify it.

3. Apart from the economic aspects of development, a considerable number of technical problems have yet to be solved. Mr Scherp's development has amply shown the impact of aerial topdressing and oversowing. The question that needs answering now is: What would the result have been if a greater amount of subdivision had been superimposed on this development programme?

4. The point has been made earlier in this article that the rate of development has a significant effect on profitability, and although this is usually controlled by the financial situation, physical techniques also exert a considerable influence. Once we have the correct answers to initial and maintenance topdressing levels, correct subdivision, and the rate of increase of carrying capacity, some of the uncertainty associated with development will be removed.

5. In money terms Mr Scherp's development has been profitable, but if inflation is allowed for it becomes only marginally profitable. The point must also be emphasised that this development story was triggered off to a considerable extent by the "windfall gains" associated with the 1950/51 wool boom. What the Agricultural Development Conference is really trying to do at the present moment, is to suggest ways to artificially create an economic climate similar to that of 1950/51.

6. When due allowance has been made for time and inflation, Mr Scherp's financial results demonstrate quite clearly the importance of the "capital-gains" effect associated with land development. If prices continue better than those of 1959/60 or the rate of development is speeded up land development would tend to be more profitable from the income point of view.

7. Finally it must be clearly re-stated that Mr Scherp's development is the simple story of the impact of aerial topdressing and oversowing, virtually unaffected by the influences of subdivision and large increases in stocking rates. Its example of the increases in stock production which are possible is so clear as to make one wonder why more farmers of hill country in New Zealand have not followed suit. Presumably uncertainty as to the ultimate economic outcome is one of the major stumbling blocks to development. At no stage during the development could Mr Scherp clearly answer the question: Will it pay? What he was convinced of, however, was that he could not afford not to develop.

TABLE 1

Topdressing and Oversowing

	Year	Time	Approx. area acres	Quantity super tons	Seed Clover lb	Grass lb
Stage 1	1950	Aug.	160	10	—	—
Stage 2	1950-51	Jan.	1000	100	1400 sub.	—
	1951-52	Jan.	1300	85	1960 sub.	—
	1952-53	Jan.	1000	75	—	4000 cocksfoot
	1953-54	Jan. & Mar.	1000	*91	—	—
Stage 3	1954-55	Jan.	1740	130	2240 red	
	1955-56	Jan.	1740	130	4000 red	2240 cocksfoot
	1956-57	Jan.	1740	130	1717 sub. 1500w/c.	—
	1957-58	Jan.	1740	100	1500 sub.	8200 ryegrass
	1958-59	Jan.	1740	100	—	2000 ryegrass
	1959-60	Jan.	1740	100	—	1800 ryegrass
	1960-61	Jan.	1740	100	1388 cowgrass	—
	1961-62	Jan.	1740	100	1505 cowgrass	—

*Includes 15 tons of molybdic super.

Note: Also in August 1956 a spring sowing of seed was made on the ewe and wether blocks, using 5000lb of perennial ryegrass, 1000lb of red clover, and 1000lb of H1 ryegrass.

TABLE 2

Stock

Year	Sheep Shorn	Sheep Sold	Cattle Carried	Cattle Sold
1948/49	1462			
1949/50	1500			
1950/51	1568	693	3	—
1951/52	1490	423	5	3
1952/53	1717	511	5	2
1953/54	2037	825	3	1
1954/55	2183	643	5	—
1955/56	2211	593	25	12
1956/57	2445	748	60	57
1957/58	2552	842	68	63
1958/59	2685	986	62	74
1959/60	2679	746	130	37
1960/61	2743	760	162	88
1961/62	2777	619	184	36
1962/63	2900	—	211	—

TABLE 3

Wool

Year	Total Wool Production	Production per Sheep	Production per Acre
	lb	lb	lb
1942/43	9,272	7.9	5.3
1943/44	9,794	8.1	5.6
1944/45	9,834	7.7	5.6
1945/46	11,975	8.7	6.9
1946/47	13,081	9.2	7.5
1947/48	13,894	9.5	8.0
1948/49	13,973	9.5	8.0
1949/50	14,141	9.4	8.1
1950/51	13,995	8.9	8.0
1951/52	17,199	11.5	9.9
1952/53	19,902	11.5	11.4
1953/54	19,456	9.5	11.2
1954/55	21,700	9.9	12.5
1955/56	25,724	11.6	14.8
1956/57	29,890	12.2	17.2
1957/58	25,998	10.2	14.9
1958/59	28,307	10.5	16.2
1959/60	27,039	10.1	15.5
1960/61	30,072	11.0	17.3
1961/62	29,087	10.5	16.7
1962/63	33,000*	11.4*	19.0

*Estimate.

TABLE 4

Meat Production

Year	Total Meat Production	Production per Acre			
	lb	Lambs	Mutton	Beef	Total
				lb/ac.	
1954/55	38,944	4.1	16.6	1.7	22.4
1955/56	47,983	4.6	19.2	3.8	27.6
1956/57	65,119	3.6	19.3	14.5	37.4
1957/58	47,154	4.3	12.3	10.5	27.1
1958/59	53,940	5.0	18.5	7.5	31.0
1959/60	64,728	4.2	19.8	13.2	37.2
1960/61	66,816	4.4	19.8	14.4	38.4
1961/62	70,470	4.6	19.4	16.5	40.5

TABLE 5

Costs and Returns

Year	Cost of Super, Lime and Seeds		Total Additional Expenses		Total Additional Net Revenue	
	Money Values	1959/60 Values	Money Values	1959/60 Values	Money Values	1959/60 Values
	£	£	£	£	£	£
1948/49	505	577	530	616	—530	—616
1949/50	595	680	480	537	73	—526
1950/51	2315	2872	2511	2944	4020	—1475
1951/52	2106	2178	2252	1868	—465	—1148
1952/53	1858	2074	2421	2177	450	—373
1953/54	2352	2590	3301	3020	212	—1868
1954/55	2830	2908	3599	3079	92	—1039
1955/56	3169	3301	4249	3727	—334	—1146
1956/57	3241	3387	4869	4363	2196	2272
1957/58	2891	2900	4438	3718	2706	698
1958/59	1817	1794	3006	2247	281	1877
1959/60	1868	1868	3743	2902	—160	374
1960/61	1867	1863	4110	3251	1521	1354

Note: (1) The above figures have been adjusted according to the restrictions of economic analysis, and are presented only to give an appreciation of the size of Mr Scherp's development.

(2) The two columns of total additional net revenues give an estimation of the streams of additional income resulting from the programme of development. It is from these streams that the profitability of the development has been calculated.

OUR COVER

Raoulia lutescens, better known as the "scab-weed" of depleted tussock grassland, usually grows as a low, flat cushion. In the development of new tussock grassland on bare ground such as stable river beds, it forms a seed-bed for other plants such as tussocks. On depleted country it protects the soil beneath it from frost lift and wind blow and provides a base for regeneration either by natural seeding or by oversown and sod-seeded grasses and clovers.

The plant shown on the cover is growing in an area which is actively eroding. As the soil around it has been lifted by frost and washed or blown away the *Raoulia* has grown downwards in a valiant effort to maintain its existence. In doing so it has protected eight inches of top-soil against erosion.

[Photo: R. C. Blackmore]

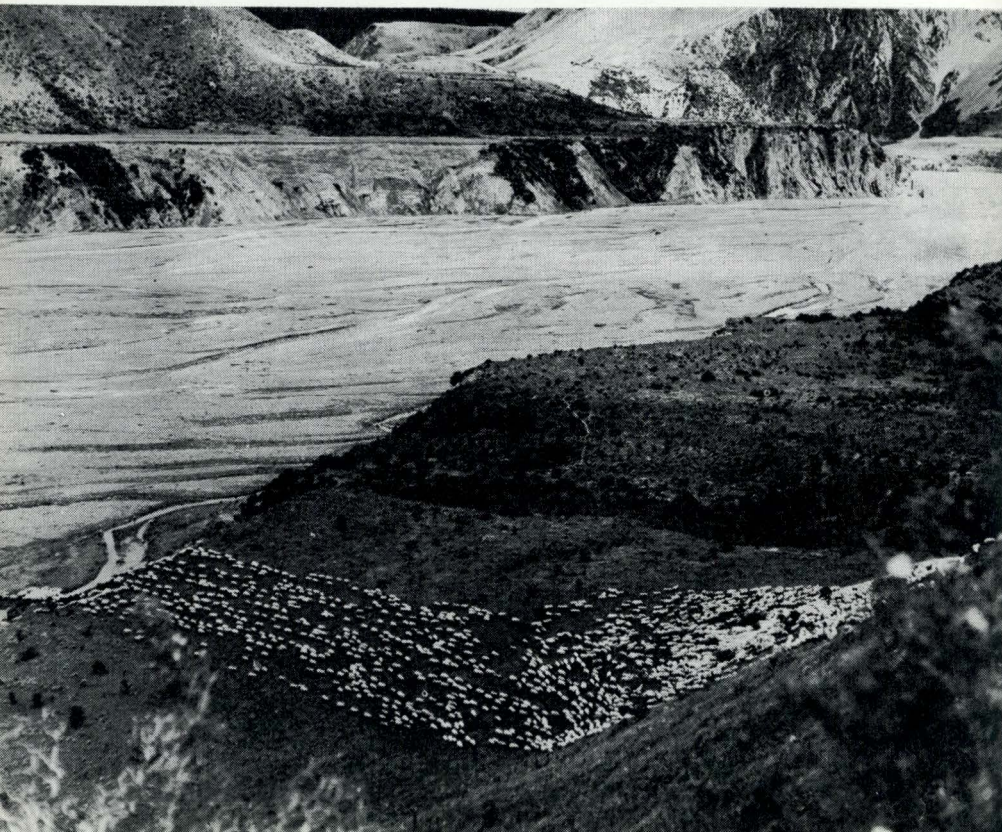
HIGH-COUNTRY FILM—"WAYLEGGO"

Most runholders will remember "The Snowline is their Boundary," a documentary film produced by the National Film Unit in 1955. This film covered many of the activities of high-country runs and was accorded excellent reviews when it was shown in other countries.

During the past year the National Film Unit has produced another film on the high country but this time it is told as a story about a group of men on a large station. It deals with the initiation of a musterer to life on the station, showing the training of dogs, breaking of horses, marking of calves, dipping of sheep and ends with the main autumn muster of 12,000 sheep. Mr R. Kingsbury, a film director of the National Unit planned and directed the film and Mr B. Latham was cameraman. The whole of the shooting was done on Mt White Station in the Waimakariri Catchment.

The 35mm version of the film will shortly be shown on the theatre circuit and later a 16mm version will be available through the National Film Library for showing to schools and meetings of farmers.

The illustration shows part of a mob of 8,000 which were filmed crossing the Esk River.



THIS QUESTION OF TOPDRESSING TUSSOCK GRASSLAND—AND USING IT

J. G. Hughes, Management Officer

Topdressing and the fencing that goes with it, cost big money. Spend wisely—don't rush in and topdress large areas if you have no idea what the results will be. There could be a great display of clover the first spring and then disillusionment. It has happened all too often.

The Institute most strongly recommends that when you make up your mind to go, you start on a small area, chosen after real thought and decision to give it everything it needs to reach the highest possible level of production as quickly as you are able—perhaps heavy and frequent fertiliser dressings, close fencing, big mob-stocking, insecticide. Find out what the problems are and solve them on a small area before you tailor a programme to suit your resources and commit yourself to spending money on a bigger area. Confidence is needed, and with it a purpose and a plan.

Why do it at all?

Topdressing is a specific treatment for a specific problem—a particular aid to the growing of more feed for stock. If it is to be done it needs just as much thought and preparation as the decision to grow a certain area of turnips for winter feed or to start saving hay. The worst possible way to go about it is to fly on a few tons in the hope that something will grow and that there will be some stock around to eat it.

Within the limits of its climate and topography each run has its own bar to increased stock production. It could be a shortage of winter feed for hoggets or no tupping feed for ewes or something else. If that one problem can be eased by better feed from an area of improved pasture, then most likely another bar to the next rung on the ladder of production will turn up in its place. This, too, may be able to be solved by improving yet a further area of country—or by changes in some other practice. The point is that topdressing, on many soils, can help tremendously in increasing the grazing capacity of pasture but when it is done it must be done properly and for a particular reason.

Therefore, some real decisions must be made.

Where?

Which area of soil will give the most economic response to fertiliser —while at the same time fitting in with seasonal management? The Farm Advisory Officer will be able to point out these areas of useful soils.

How big an area?

How many acres of improved grazing will be needed to help with the particular feeding problem? Not only must you be able to find out the grass-growing potential of the soil but equally as important, *how many stock will be available to graze it?*

Except for ewes with lambs and weaned lambs themselves, mob-stocking—that is, big numbers of sheep for short periods—is the best

way to handle topdressed pasture. "Big numbers" will mean anything from 15-20 sheep to an acre or more depending on the type of country. If rough, scrubby growth has to be knocked down, even 60 sheep or more to the acre (preferably dry at this rate) and grazed with or preceded by cattle, might be needed. You might, for instance, want to make special use of the improved area by the two-tooth mob. Perhaps there are 3,000 and you will aim for short-term grazing with 20 to the acre. Then an average size of block will need to be 150 acres. Seeing you will need to cycle your mob from block to block, perhaps four or five of these could be needed. A deuce of a lot of fencing? I agree, but again the point is you have to be prepared to face this just as you have to face the first and continuing cost of the fertiliser if you want to get real results. It is a compelling reason to start in a small way.

Big swings of feed supply between ample and near-starvation can happen if the intervals between changes of block are too long at these high stocking rates. This can cause dietary troubles and is partly why the system is not popular with some people. It stands to reason, however, that if the periods are kept short the swings are lessened in size and the food supply is more constant. Ideally the period between changes should be two to three days but this can more practically be stretched to a week. The right size of mob should therefore be one big enough to cut down the feed without preference in that time but not be so long on the block as to eat it out. Overgrazing slows recovery. The size of mob will, of course, vary from season to season. Mob-stocking is almost essential for control of scrub re-growth.

How about all this fencing?

The idea is to build up a framework of strong, permanent fences along main ridges or valleys or elsewhere to separate major classes of country. On these "bones" can be hung, as development progresses, the grazing-control or "management fences," lighter fences perhaps, electric fences or built of netting, temporary in the first instance but capable of being strengthened up with more posts if still needed later on.

The small blocks so formed should be of a size worked out to give this fairly-high stocking intensity for control of the improved pasture. Only a small part of the property need be fenced this way for a start. As the improved area and the flock size gradually increase, so then does the area closely fenced. As the flock grows too, and the size of the class mobs within it, some of these fences may be unnecessary since the same heavy stocking intensity can be got with bigger mobs on bigger areas. It could even be that some of the present-day blocks might in time be the right size for intensive grazing with a bigger flock, as they are today for extensive grazing with a smaller flock.

Upper: *Runholders discuss tussock improvement at Broken River, Canterbury.*

Lower: *Oversown fescue tussock at Broken River.*

What Seed and Fertiliser?

Ask your farm adviser. He has the district experimental experience to tell you what seed and fertiliser is needed and the rate at which it must be applied to really start producing an abundance of feed. The sooner the "basic" deficiency of phosphate or other mineral is met, the sooner will the higher-producing grasses start thriving. Heavy manuring on small areas is much to be preferred to light manuring on large areas.

The biggest early response will, of course, be from clover. As soon as this shows real growth it should be grazed quickly but not too heavily, spelled, then if possible grazed again. A "smothering" growth of clover must be avoided at all costs. In fact, although it might seem pointless when it is really grass that is wanted, perhaps three or four hundredweights of superphosphate or even more (all dependent on climate and soils) could be applied to push clover growth to intense activity. The clover is, unless it is wanted itself as fodder, only a means to an end. That end is the growing and nourishing of more and better grass. Strongly-growing clover, heavily grazed at intervals will by itself and by the dung of the stock it feeds, soon help the soil fertility to rise to a level where grasses, both introduced and resident (even many despised today), will flourish longer, produce more feed, and better resist winter frosting. Clover itself, of course, is usually of little use in the winter.

Summary

Thus, in its simplest form, if you plan to topdress make up your mind thoroughly before you start:

What are you doing it for?

What class of sheep are you going to graze on it and how many of them are there?

Which soil will give you the cheapest response?

Will it be available in the season you want it and will it fit in with flock management?

What and how much fertiliser is needed to quickly satisfy the natural mineral deficiencies of the area?

What will be the season of use and thus what new plants are needed to provide feed at this time?

Knowing how big a mob you will be using and having decided on a grazing intensity, what size of blocks will you need and how many of them?

Can you afford it now? Can you afford to keep it going?

The foregoing has, of course, been a deliberate over-simplification of reasoning to bring out a framework. Each soil, each climate region, each run, will be different, will have it is own particular problems to solve. Start in a small way and your "know how" will keep pace as your developed area and the size of your flock grow also.

If you decide to go ahead then you must aim to get the highest possible return for every pound spent. The foundation for this is to get grazing control of an improved-fertility pasture by adequate manuring and adequate stocking.

Anything less can be a waste of money and effort.

TOPDRESSING AND MANAGEMENT DEMONSTRATIONS ON TUSSOCK GRASSLANDS

G. A. Dunbar, Agronomist

Although many thousands of acres of tussock country have been topdressed over the past 14 years, results have not always been sufficiently encouraging for runholders to extend this work or even persist with the original area treated. In some cases responses have been poor from the start, but even where initial responses have been excellent, sometimes from quite low rates of topdressing, subsequent lack of persistence of clovers, failure of good grasses to come in, and in many cases the development of a dense browntop turf, have given cause for dissatisfaction with topdressing as a means of improvement.

Discussions at the seminar on grass introduction organised by the Institute last June pointed out the extreme importance of maximum utilisation by the grazing animal of the increased herbage produced as a result of topdressing, and evidence from experimental work suggests that failure to develop a good grass/clover balance may be due in part to failure to boost fertility sufficiently by the combination of high rates of fertiliser and heavy stocking.

It was with these points in mind that the Institute decided after the seminar to establish a small number of cooperative demonstrations with runholders to test and demonstrate the effects of high rates of fertiliser application, coupled with high rates of stocking.

Finance, staff and time available have limited the scope of this work, but four demonstration areas were established during August this year. The establishment of the optimum rates of fertiliser for maintenance remains one of the most pressing and difficult problems, involving as it does the complications of rates of stocking, and is beyond the scope and intention of the demonstration paddocks established by the Institute. However it is hoped to show by these demonstrations that there is considerable added benefit to total production and to the grass/clover balance of the pasture through these heavy applications and heavy stocking.

In selecting the four sites for the small paddock demonstrations, importance was attached to choosing soils which were representative of large areas of tussock country, and, within the limits of reasonable access, covered a cross-section of climatic conditions. Messrs C. C. Vucetich and J. E. Cox of the Soil Bureau of the Department of Scientific and Industrial Research gave invaluable advice in this respect. The Institute has also been fortunate in having the advice and cooperation of Messrs R. L. Bennetts, C. C. McLeod, R. A. Milne and P. Thaine of the Department of Agriculture in selecting sites and treatments for these demonstrations, and above all has appreciated the willingness of the runholders to cooperate in the demonstration. As these plots will be maintained for four or five years, and will need stocking at varying intervals according to growth, this willingness should be a major ingredient of success.

The Institute is grateful to the firm of Kempthorne Prosser and Co. Ltd. who donated all the fertiliser used in the trials.

The four plots range from the Lowry Peaks Range in the north to the Rangitata Valley in the south. Each of the four demonstration plots has been established on a distinct soil, and it is probably best to outline conditions and treatment of the plots under the headings of the soil names. These names have been assigned by Soil Bureau to soils mapped by them in the South Island, and the assignment of the name of a locality to them does not necessarily limit the distribution to that locality.

1. Haldon Soil. A plot on this soil has been set up on the Mt Palm property at Rotherham in cooperation with Mr A. C. R. Robinson and his son Mr Brian Robinson. The site is at an altitude of about 1700 feet on the Lowry Peaks Range on a moderately-steep east slope. Rainfall at this altitude is somewhat of an unknown quantity but may be as high as 40 inches. The dominant cover here is good fescue and silver tussock and there is already an amount of cocksfoot present.

The area fenced by the Institute is approximately 6¼ acres. Tests showed that the soil was moderately to strongly acid (pH 5.3) but that the phosphate level was high. The major fertiliser treatment, which covers all except a half-acre of the enclosure was molybdate superphosphate at 3cwt per acre. The balance of the enclosed area had sulphur (400) molybdate super at 1cwt per acre. Outside the fence these same two treatments were repeated each on a half-acre. Seed of certified cocksfoot, inoculated and lime-pelleted white clover, and Mont. red clover was sown over all the enclosed area, and on the one-acre strip immediately adjacent to the main plot. Rates of seeding were 1lb cocksfoot, 3lb white clover and 1lb Mont. red clover to the acre.

2. Cass Soil. On Mesopotamia station in the upper Rangitata, Mr M. Prouting aerially topdressed a block of 400 acres of rolling country in September 1963, and oversowed at the same time with white clover, alsike and Mont. red, each at 2lb per acre. Clover establishment and growth during the first season were good. A small paddock of 9½ acres within this block has now been fenced by the Institute. It is slightly sloping to the north, and at an altitude of about 1700 feet. Topdressing last September by Mr Prouting was with sulphur super (400) at the 1cwt rate on this part of the block. Soil tests showed that although the soil was strongly acid, phosphate status was better than for most Cass soils, although not as good as for the Haldon soil. Eight acres within the enclosure have now been given an additional 3cwt of molybdate super per acre, and also have had 1lb of certified cocksfoot per acre. Comparison within the enclosure will be with about one and a half acres of the original topdressed and oversown area. Outside the enclosure, an additional 3cwt of molybdate super and 1lb of certified cocksfoot have been applied on one acre of the main block, and this will be compared with the original sowing.

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Upper: *Mesopotamia site.*

Lower: *Glenthorne site.*

3. Hurunui Soil. At Ashley Gorge, near Oxford, Mr M. H. Johnston and his son Mr Robert Johnston are cooperating with a demonstration on Hurunui soil. The site chosen is at about 1600 feet, on a steep north slope and adjoins a small block which has been topdressed for several years. It is well covered with a fescue and silver tussock association, but the soil is strongly acid and has a very low phosphate rating. Rainfall is probably about 45 inches per annum.

The major part of the enclosed area of 3¾ acres was topdressed this spring with a mixture of molybdate super and ordinary superphosphate equivalent to 4cwt super and 2½oz sodium molybdate per acre, but comparison will be made with a half-acre within the enclosure topdressed at 1cwt super and 2½oz sodium molybdate per acre. These two treatments are repeated on half-acre strips outside the fence, and a half-acre strip with ordinary superphosphate at 4cwt per acre has been added as a further comparison.

All of the topdressed area was seeded at the time of topdressing with certified cocksfoot, 2lb per acre, inoculated and lime-pelleted white clover at 3lb per acre and Mont. red clover, 1lb per acre.

Mr Johnston attributes some stock troubles over the past few years to the effects of molybdenum, and as a precautionary measure, bluestone has been added at 5lb per acre to the areas topdressed with sodium molybdate.

4. Katrine Soil. Glenthorne Station in the Wilberforce-Harper River region, like many high-country runs, has very limited areas of soils well suited to development. Rainfall is high, about 60 inches at Glenthorne homestead, and all but the recent riverbed soils are strongly leached and acid. At the end of July this year the station aerially topdressed an area of about 130 acres of downs and river flat near the Harper-Avoca junction, using sulphur (400) molybdate super at 4cwt per acre. Seed was applied at the following rates per acre: cocksfoot 1lb, white clover (inoculated and pelleted) 2lb, Mont. red clover 1lb, alsike clover ½lb.

In cooperation with Mr L. Askew, who manages the property for the Janet Murchison Estate, the Institute staff has fenced a paddock of 13.7 acres on the oversown downs, at about 1900 feet altitude. The enclosed area is predominantly strongly rolling, and has north, west and south slopes within it.

Due to the difficulty of excluding a small area from aerial oversowing, this enclosure does not include a low-rate topdressing, so that the main demonstration here will be a straight high stocking/low stocking comparison on the 4cwt topdressed area.

In view of the strongly-acid soil reaction (the most acid of the four demonstration areas) and to see what effect lime may have on grass establishment in particular, a simple trial has been laid down in the middle of the paddock. Here a one-acre strip was sown with 1lb cocksfoot and 1lb inoculated and pelleted white clover (additional to the

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Upper: *Ashley Gorge site.*
Lower: *Topdressing by hand brings memories of pre-aeroplane days.*

original oversowing), and crossed with two strips of lime, one strip at 5cwt per acre and one at 10cwt.

Grazing treatment. One of the problems in siting these demonstration enclosures was that they had to be in a position where stock could be moved in and out fairly readily. This is because, subsequent to the establishment of clovers, the small paddocks will be stocked at heavy concentrations for short periods, sufficient to give full utilisation of the available feed. Although the length of the grazing period and the *maximum* number of sheep per acre will depend on the success of the sowings and on the season, the intention is to use a *minimum* number of 20 sheep per acre.

Outside the enclosures, grazing will be at the normal stocking rates and times for the particular block on each property. Records will be kept of stock numbers and movements.

. . .

The Institute is grateful for the advice and interest of the members of the Department of Agriculture whose names were mentioned earlier. These demonstrations do not pretend to be of the experimental standard of the many trials which have been laid down in the past by the Department of Agriculture and by Grasslands Division (D.S.I.R.), and which have given us so many of the answers which enable people to topdress today with a high ensurance of success. They are however on a practical scale and should serve as a useful stepping stone between the smaller experimental plot and the treatment of large paddocks or blocks.

The seed is sown, the fertiliser spread and the fence is up. Along with many runholders and farmers in the tussock country, we now have personal reasons for hoping for a favourable season.

(The Institute would be interested to hear from any runholders who have been applying high initial rates of fertilisers. Where desired, staff will be happy to visit the areas and discuss results.)

STAFF

Mr J. A. Hayward, of the soil conservation staff of the Otago Catchment Board, has been appointed Planning Officer to the Tussock Grasslands and Mountain Lands Institute.

Mr Hayward, who is 26, graduated bachelor of agricultural science from Lincoln College in 1961, taking the soil conservation option in the fourth year of his degree course. For the last three years and a half he has been stationed at Alexandra, where he has been mapping land inventory and capability and producing and servicing conservation plans on farms and runs. He has also been interested in field trials on the effects of grazing and burning on soil conservation. In his work with the Institute, Mr Hayward will be concerned with the collection and coordination of all the available information on catchments under study for the preparation of recommendations on land use. He will, with other members of the staff, participate in surveys to obtain information not otherwise available, and will prepare material for presentation to the Committee of Management and for publication.

THE INTRODUCTION AND ESTABLISHMENT OF GRASSES INTO TUSSOCK GRASSLAND

The major factor affecting the carrying capacity of runs is the amount of grass available in the winter. Stock limitations on Crown leasehold under the 1948 Land Act are based on winter-carrying capacity. Any increase in these limitations during the currency of a lease is dependent largely on the ability of the runholder to grow and manage grass for the winter. Present practices of oversowing and topdressing, if successful, result in the production of clover-rich pastures and thus in greatly increased summer production. The clover nitrogen materially assists the vigour of the resident grasses but resulting increases in grass production in winter have been disappointing. Attempts at introducing improved grasses into these clover-rich swards have also been disappointing.

Many runholders are interested in the further reduction of grazing pressure on problem country, especially Class VIII land, but can make little progress unless improvement of lower country can be implemented economically at an increased rate, particularly as far as its grass content is concerned. This interest in the reduction of stock pressure on eroded high country has been stimulated by the recent decision of the Soil Conservation and Rivers Control Council to liberalise the subsidies designed to assist in the development of equivalent off-site grazing, together with the necessary fencing.

All the factors mentioned have increased the demand by runholders for more information on the establishment, maintenance and management of improved tussock pasture, particularly that with a higher content of winter grass. Consequently the Institute organised a seminar in June last which was attended by officers of the Research and Farm Advisory Divisions of the Department of Agriculture, of the Soil Bureau and Grasslands Division of the Department of Scientific and Industrial Research, of Lincoln College and of the Institute. This report of the discussions is given in the form of answers to a series of questions posed to the seminar.

1. Where is grass introduction necessary?

There was general agreement that there is a need for grass introduction of areas of bare ground and on depleted areas with a proportion of bare ground. While emphasis in the discussions was largely on production it was agreed that in some areas the problem may more urgently be a matter of soil conservation than of livestock production.

In some places it may be desirable to attempt to establish high-quality grasses even though there may already be a perennial grass cover of such species as brown top, sweet vernal, danthonia and Yorkshire fog.

Production from these areas depends on fertility (including a satisfactory rainfall) and aspect. In places, brown top and fog can produce, at times, as well as does perennial ryegrass. Where areas are needed for summer grazing, then Yorkshire fog and brown top with a good content of clover can be satisfactory. For use in late autumn, winter

and early spring, the introduction of cocksfoot and ryegrass should be considered.

2. What species are advised for various conditions?

(a) *Semi-arid zone.*

Cocksfoot appears to be able to stand the winter best on the brown-grey earths. Regeneration of native grasses should be encouraged by spelling for at least one year initially and afterwards spelling in the seeding period. Past introductions were largely made without fertiliser and there should now be trials using fertiliser with new strains of cocksfoot, tall oat-grass, tall fescue, ryegrasses and some of the species of *Agropyron*. At low levels of moisture, present advice would be to spell rather than to sow grass. The plots sown in 1920 by Dr L. Cockayne on the Northburn Run on the Dunstan Mountains near Lowburn, show today that the semi-arid soils can definitely support a perennial vegetation. Regenerating annuals might be used as the cover into which perennial grasses are introduced.

(b) *Sub-humid zone.*

Cocksfoot again seems to be the best advice at present but dogstail at ½lb should be considered in addition because of its ready establishment. Ryegrasses are also advocated for the deeper soils and consideration should be given to trials with the new strains of tall fescue and of some species of *Bromus*. With moister conditions, timothy should be considered and also the new selection of Yorkshire fog of which it is hoped seed will soon be available. Further grasses which should be tested in this zone are species of *Agropyron* and Chilean species of *Festuca* and *Deschampsia*. It is possible that an annual clover would fit in with the conditions in this zone and various strains of subterranean clover should be tried.

(c) *Humid zone.*

(i) High-country yellow-brown earths.

It is doubtful if grasses should be sown for production in this zone above about 3,500 feet. For soil conservation purposes at these and greater altitudes it may be necessary or desirable to use fertiliser for the initial establishment of cocksfoot, ryegrasses and tall fescue. Once stabilisation has been achieved, native grasses may be able to take over. Further work should include trials with alpine species of grasses from sub-continental and island regions.

(ii) Upland yellow-brown earths.

Cocksfoot is first choice but timothy and ryegrass may be used in favoured sites. Dogstail also has it advocates. Improved strains of tall oat-grass should be considered for use on stable ground which is situated in areas liable to be intensely stocked. When seed of the new strain of Yorkshire fog is available it also should be tried.

(iii) Lowland yellow-brown earths.

Again cocksfoot is advised but it should be recognised that provided they have clover and fertiliser, existing swards of brown top may produce extremely well. Timothy is suggested for damper

sites and, where snow and frost are severe, the new strains of tall fescue should be tried.

3. Should we be attempting to make use of native species of grass?

On existing knowledge, no native species are advocated but the following should be considered for trial and supplies of seed obtained:

Agropyron scabrum—mainly for semi-arid and sub-humid zones.
Dichelachne crinita, Deyeuxia spp. and *Poa colensoi*—for all zones.
Notodanthonia spp.—for all zones but especially for the semi-arid.
Agrostis petriei—for Arrow soils in the sub-humid zone.
Festuca matthewsii—for upper mid-altitudes of the sub-humid zone.
Koeleria spp.—where Yorkshire fog grows or is being tried.

4. What methods of introduction should be used?

There was little support for the sowing of grass alone except where suppression by vigorous growth of clovers is feared; in such a case consideration should be given to sowing the grass one or two years before the clover. Cocksfoot and dogstail can both grow under conditions of low fertility and, if sown before or with clover, can persist through the clover-dominant stage. Introduction of grass into clover-rich swards is possibly best done in the autumn when the clover is weak. The seminar gave little support to the idea of obtaining a build up of nitrogen from clover before sowing the grass; rather should we sow with the clover and trust the grass will persist while the fertility is being rapidly built up.

It was agreed that much more research is needed into the methods and time of year for the introduction of grass.

5. Should lime be applied when introducing grass?

There are widespread examples of the value of lime in aiding the establishment of grasses but the only definite recommendation at present is that there should be further research. (A research project to assess more accurately the place of lime in grass establishment is now under way with the Grasslands Division, Lincoln College and the Institute cooperating.)

6. Should grass seed be pelleted?

At present there is no satisfactory system of pelleting available but further work is advocated, especially with attempts to stick the seed on to the fertiliser pellet rather than have the seed within the pellet.

7. Is trampling with stock necessary after sowing grass?

This practice is desirable but is not often practicable with the present size of blocks in tussock country. It is, however, possible where intensity of stocking for short periods can be brought up to 15 per acre. Especially in heavy brown-top country, introduction of grass is assisted by heavy grazing beforehand, followed by trampling after sowing.

8. What influence has grazing on establishment?

Most seed and fertiliser seems to be applied in July-August. In drier areas, stock should be moved in October at the latest and kept off until February. With better rainfall, growth may be such that early-

summer grazing should be done. Where there is good clover growth, failure to graze in summer may increase losses due to porina and grass grub. It is probable that some failures of grass establishment are due to attacks of these insects on the seedlings. We need more research work on grazing management in the first year.

9. What should be the initial and maintenance applications of fertiliser?

The recommendations listed in the Review No. 4 should normally be considered as minimum applications. In most cases amounts could profitably be increased and maintenance must be continued through the clover-dominant stage. It is essential that what is grown should be eaten. Experience increasingly indicates that success with the establishment of grasses involves treating smaller areas with heavier initial and subsequent rates of fertiliser and ensuring adequate control of growth by careful stock management.

It was stressed that before we can expect much advance in the areas of tussock treated, the advisory officers must be more explicit with advice which must be based on actual evidence. To obtain this there should be trials such as using as much as 4cwt per acre of fertiliser initially and 2-3cwt per acre as maintenance in alternate years, under grazing as needed and carried on for several years. (See article by Mr Dunbar in this issue.) In any planning of the use of fertiliser in tussock improvement it should be remembered that:

High-country yellow-brown earths have a high phosphate retention.

Yellow-brown earths have a medium phosphate retention.

Yellow-grey and brown-grey earths have a low phosphate retention.

In trying to decide whether the initial application shoudl be of superphosphate or sulphur superphosphate, a quick test for P can provide a good guide and the Farm Advisory Officer should be consulted.

What size of blocks should be aimed at in improvement work on tussock?

A rule of thumb is suggested that blocks should be of such a size that they can be grazed when necessary at the rate of 20 sheep per acre, certainly not less than 15 per acre. The subdivision fencing necessary could be temporary until the improved pasture enables the flock to be built up sufficiently to graze the present size of blocks at the correct rate. A combination of sheep and cattle is of great assistance in giving satisfactory control of growth.

The seminar also discussed the question of the introduction into New Zealand of grasses or strains of grasses not already here and the necessity for testing all promising available strains for their suitability for use in the tussock grasslands. The Institute was asked to call a further meeting of interested parties to go into the details of a research programme of plant introduction and testing for the tussock grasslands and to set up a standing committee to review progress continually. A meeting was accordingly called in August and after consideration of various aspects, a committee of six was formed to continue investigations.

A full report of the initial meeting and of the work of the committee will appear in the next Review.

THE MISS E. L. HELLABY INDIGENOUS GRASSLANDS RESEARCH TRUST

In December 1959, by Deed of Trust, Miss E. L. Hellaby of Auckland established a fund to promote research into the indigenous grasslands of New Zealand. The intentions of the gift were to encourage scientific work in the University, to assist the training of young scientists and to produce information of value to the primary industries of New Zealand. The income of the Trust is to be applied mainly to provide fellowships to enable suitably-qualified graduates to work for research degrees in New Zealand Universities on problems connected with our tussock grasslands.

The scientific policy of the Trust is decided by an Advisory Board which at present consists of Dr L. J. Wild, Otaki Beach (chairman); Dr E. J. Godley, Director Botany Division, D.S.I.R. Lincoln; and Dr G. T. S. Baylis, Professor of Botany, University of Otago.

The first fellowship, one of three years, was awarded to Dr A. F. Mark, M.Sc. (N.Z.), Ph.D. (Duke, U.S.A.). By arrangement with the University of Otago, he made his headquarters at the University and was given the status there of Lecturer in Botany with leave of absence to work full-time for the Trust. His work dealt with the ecology of the narrow-leaved snow tussock in Otago. Eight sites ranging almost from the east coast to the main divide, and from 1,500 to 5,350 feet, represent most of the very wide distribution of this tussock species in Otago and probably the South Island where it dominates most of the run country between 2,500 and 6,000 feet to the east of the main divide.

Growth, flowering, seeding and germination have been studied and related to the important environmental factors. A transplant experiment and others have revealed some interesting and important features of this snow tussock, many of which are of practical significance for both the runholder and the soil conservator. In particular, the effects of burning and/or grazing indicate that the snow tussock shows certain adaptations to fire. These adaptations, however, can be counteracted by grazing during the recovery period, and the degree of damage seems to be directly related to the intensity of grazing during this period.

The results of Dr Mark's study will be published in a scientific journal but, for the benefit of runholders, a modified version will be supplied for this Review.

The second fellowship, for the year 1964, is held by Mr C. J. Burrows, Lecturer in Botany at the University of Canterbury. This will enable him to complete work for a doctorate thesis commenced in 1960. Mr Burrows has been investigating the ecology of the alpine grasslands in which are present *Chinochloa pallens* (midribbed snowgrass), *C. crassiuscala* (curly grass), *C. australis* (carpet grass), and *C. oreophila* (snow-patch grass). Extensive sampling of the vegetation has been carried out in order to obtain an understanding of its composition. Measurements of climate have been made and a survey of soils associated with

the grasslands undertaken. During 1964 the major work has been soil analysis, the analysis of standing crops, and the examination by pot experiments in the greenhouse of the influences of important environmental factors such as temperature, light, and soil moisture.

The results of this study should significantly increase our very limited knowledge of these important mountain grasslands.

Mr D. G. Lloyd, B.Sc. (Hons.), of the Botany Department, University of Canterbury, has been awarded a fellowship for three years from November 1964. Mr Lloyd has recently been at Harvard University, U.S.A., under a Frank Knox Fellowship and is at present visiting institutions in Britain and Europe. Mr Lloyd intends to investigate the pollination, fertilisation and seed production of several species of grasses in the tussock grassland.

USE ONLY FIRST-CLASS SEED

The High-Country Committee of Federated Farmers has asked the Institute to give publicity to the desirability of using only first-class seed when sowing pastures, whether it is by oversowing from the air, sod seeding or on cultivated ground.

We can only reiterate that it is highly desirable, where it is available, to use certified seed. There are five classes of certified seed in the New Zealand certification scheme, but for the farmer sowing for grazing only, and not for seed production, the lowest class, "certified Permanent Pasture," is just as satisfactory as the higher classes. Moreover it is usually cheaper.

Some kinds of seed sown are not yet included in the certification scheme. In these cases the best possible quality should be used.

In all cases farmers should insist on seeing the latest "Purity and Germination" certificate before agreeing to purchase. Particular attention should be paid to the weed species listed on the certificate. The article in Review No. 5, September 1964, will assist in deciding whether the impurities are those which could be harmful if sown on tussock grasslands.

PRACTICAL WORK FOR LINCOLN COLLEGE STUDENTS

Each year the Institute receives requests from students of this College for placement on runs during their long vacation. Usually this is to partly fulfil their practical-work requirements.

The period for degree students is four months from the beginning of November to the end of February and for diploma students six months from mid-August to the end of February.

Most of the students concerned already have reasonable farm experience and a particular interest in the run country.

The Institute would welcome enquiries each year from runholders who would be prepared to employ such extra seasonal labour.

COOPERATIVE FERTILISER AND GRAZING TRIAL

The Grassland Division of the Department of Scientific and Industrial Research, in addition to much other research work in the tussock grasslands, is carrying out five major trials designed to investigate the relative importance of fertiliser and grazing practice in the management of improved tussock grasslands. These are located on the Tara Hills Research Station and Ribbonwood Station, in the Waitaki Valley and on Ben Ohau, Katherine Field and Glentanner Stations, in the Mackenzie. In response to a keen demand for information of this nature on the Kakahu soils which cover hundreds of thousands of acres in Otago, Waitaki Valley and Canterbury, the Institute organised a similar trial on the Mt Dasher property of Mr J. M. Wardell, North Otago.

The Institute provided the fencing materials, Mr Wardell undertook erection, the Soil Bureau are making a detailed study of the soil (with chemical analyses being carried out by the Department of Agriculture), the Grasslands Division applied various treatments and will make the detailed measurements, and the Otago Catchment Board who have prepared a run conservation plan on the property are also assisting.

The area involved was fenced into 40 separate plots and sown with two pounds per acre of white clover and four ounces per acre of molybdenum. Varying rates of flowers of sulphur and gypsum were used with low and high rates of double superphosphate. There are four replications of each of 10 treatments. Half the plots will be lax grazed when ready and the other half hard grazed. The provision and handling of the necessary sheep will impose a heavy load on the owner for the two to three years of the trial and the cooperating organisations are very grateful for his assistance.

LAND CAPABILITY CLASSIFICATION EXPLAINED

We regret that in the article on Land Capability in Review No. 6, March 1964, the list of acknowledgements for the photographs was not printed. We wish to acknowledge the cooperation of the following in supplying photographs.

North Canterbury Catchment Board (p. 25 upper, p. 31 upper, p. 33). R. C. Blackmore (p. 21 lower, p. 23 lower, p. 27 upper). Soil Conservation and Rivers Control Council (p. 25 lower, p. 29 lower). Christchurch Press (p. 23 upper). V. C. Browne (p. 29 upper).

TUSSOCK GRASSLANDS AND MOUNTAIN LANDS INSTITUTE

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