PAPER READ AT THE ANNUAL CONFERENCE OF THE "NEW ZEALAND GRASSLAND ASSOCIATION."

by

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HILL COUNTRY GRASSLANDS OF THE ORIGINAL BUSH DISTRICTS.

The felling, burning and grassing of some 11,000,000 acres of bush-clad hill country in New Zealand has for a number of years provided grazing for a large population of sheep, more particularly in the North Island; In the earlier years of this development, the resultant pastures were luxurious, following the thick coating of ash remaining after the forest fires.

Of the 11,000,000 acres cleared and, surface Sown about 4,000,000 acres have rapidly deteriorated and are now more or less in the grip of secondary forest or other useless growth, and it seem% problematical in the meantime whether a fight to save this country would prove economically sound.

For some time it has been the popular opinion of those fairly well acquainted with the hill country', including many of those farming it, that much of the remaining 7,000,000 acres of better type hill country grassland has also deteriorated to varying extents in. carrying capacity, and it is to this type' of country that the following remarks apply.

'In tracing the development of this hill country it is quite evident that many of the sown pasture mixtures were notalways suitable, for although wonderfully luxuriant in the initial period, it early became apparent that the high-fertility-demanding species began to wane, as the dressing of wood ashes was used up and these better species have been steadily replaced by danthonia or browntop or other less valuable growth. As the better species weakened, so their punishment became greater from the selective grazing activity of the sheep, yet nevertheless, even today, in many instances, the more or less weakened remnants of cocksfoot, dogstail, white clover and trefoil still remain in the swards in which danthonia and browntop are dominant, and as a result the sheep carrying capacity has decreased. Not only has the sheep population decreased over a period of years, but there has arisen the necessity to carry larger numbers of cattle to obviate the replacement of the pastures by fern, bidi bidi, etc. In addition it has been suggested that lambing percentages are lower than previously in certain areas. That the welfare of this hill country is a matter of major national importance is clear, when it is realised that the flocks of this country provide the foundation for the production of one of New Zealand's most valuable exports, i.e., fat lamb.

The present existence of the fat lamb trade in the North Island is dependent on the annual draft of aged cast ewes from the hill country, and it is only reasonable to suggest that if the mother of the fat lamb is lowered in quality and breeding efficiency, it will certainly be reflected in the fat lamb trade.

It is not widely realised that the continuous strain placed on the hill country grassland by the rearing of large-framed long-woolled sheep is likely to result in a difficulty sooner or later unless the matter is tackled in a determined manner.

surface covering of any area is dependent on its soil and climatic conditions - the effect of management may induce a more or a less desirable vegetation. Under an extensive system of operations and unless natural conditions are extremely favourable, the unguided efforts of man in the handling of his grazing animals, both wild and domesticated, will usually result in the succession of economically less valuable pasture plants so that the surface covering to-day is very different from that of 70 years ago. Our wider knowledge, however, should result in the prevention of depletion in the semi-arid areas, the regrsssing of low production grazing country, the elimination of such worthless species as fern, scrub, and the weed grasses, and the adoption-of economic methods of pasture production on all the more intensively managed areas.

Time will not permit any detailed description of even the major grassland types and their various problems, and so I have endeavoured to classify the problems mentioning at the same time the class of country to which they refer.

PROBLEMS IN ECOLOGY.

What might loosely be termed ecological problems are of fundamental importance over the vast tracts of unimproved land. The scale of operations necessary as well as the present state of our land settlement is all against any costly systems of improvement. There is, however, urgent necessity for investigation of the existing pasture species and the effect on them of spelling, and of burning, of how to establish more valuable species and how to encourage their spread. As an illustration of this mention might be made of the Australian salt-bush whose introduction has been suggested by a run-holder in the Kurow district. This has, I believe, distinct possibilities for the driest areas not only as a feed-producer, but also to provide shade and shelter to encourage the establishment of better grasses. Many other introduced species might be suggested while a close study of the growth characters of the more valuable native species is of supreme importance; For example, among the Danthonias strains may be selected of higher palatability and greater production under semi-arid conditions. All country held in large areas, all very dry country and all rough country, presents an interesting range of such ecological problems.

PROBLEMS IN SOIL IMPROVEMENT.

Where attempts are justified to improve the present soil conditions, these must receive first consideration - drainage to prevent waterlogging, cultivation to provide a seed-bed and the use of lime and fertilizers to raise the fertility. Each of these subjects would merit a separate paper. An interesting question at the moment is as to the possibilities of pasture improvement by top-dressing the existing grassland with little or no cultivation. On much of our brown-top country, where diminutive ryegrass plants still persist, considerable improvement can be effected by top-dressing alone or accompanied by grass-harrowing. The advisability of this procedure can only be decided by a close examination of the sward and in view of the cultivation programme for the farm as a whole. As a general rule I believe that ploughing and the re-establishment of a pasture of a truly perennial character is the ideal at which to aim, and this may prove cheapest in the long run. On tussock land it is certain that a great deal of the ploughing formerly carried out was a mistake, and future improvement will be in the direction of preserving the tussock for shade and shelter and devising grass mixtures on scientific lines to establish without ploughing.

Economic conditions have unfortunately led to a very considerable decrease in the use of fertilizers for top-dressing, and in the 1932 season only some 4% of the sown grassland of Otago and Southland was top-dressed and less than 2% is recorded as having been limed.

This is not, however, indicative of any diminishing interest in the problems of liming and manuring and the present lull must be followed by a period of considerable activity in this direction. I am avoiding any discussion of the relative value of lime as against phosphatic fertilizers or any comparison of values between one fertilizer and another since this is a subject where generalisations are useless - if we knew enough about the subject each soil type provides its special problem.

PROBLEMS IN ESTABLISHMENT.

Under this heading may be considered both the species to be recommended and the methods of sowing. Largely owing to the splendid work of the Department of Agriculture both in research and extension we have during the past three or four years noticed a decided shifting of attantion from the manurial aspect to the pasture--strain aspect of grassland improvement, and it will be agreed that the latter is in point of time the more important. First establish the right class of pasture and then maintain it by correct management methods.

The value of true perennial ryegrass is now widely appreciated and mention of it will be constantly recurring during the present Conference. It would be difficult to overestimate the possibilities which this grass offers. It has been said that New Zealand recovered from the slump of the eighties largely through the development of refrigeration, end it is certain that one of the major aids to recovery from the present slump will be the extension of the use of true perennial ryegrass in our pastures and for seed production. When one has seen the persistence of this grass, through Winter cold and summer drought, one realises what its adoption will mean to thousands of acres which are at pre sent of low production. In like manner also would I refer to the improved certified strains of white clover and cocksfoot. With the above - msntioned pasture plants the problem of what to use for the bulk of the mixture can be considered to be solved, there still remains the problem of convincing the user of their outstanding value. When tried at first in Southland, Hawke's Bay ryegrass, as it was then called, met with the objection that it was lower in palatability than the southern ryegrass, but this objection is now satisfactorily answered. One disadvantage remains in regard to the seed-growing industry of Southland since it is found that seed groan in tho wetter districts from ths cartifiad perennial is deplorably low in germination.

Pasture plants of secondary importance - dogstail, timothy, foxtail, alsike, red clover varieties and Lotus Major havs each a sphere of usefulness. Two species commonly sown in the North, but rarely tried in the South are Poa trivialis and Subterranean Clover, with the latter encouraging results are being shown, but I believe that certified No.1 White will be little behind the Subterranean in early Spring growth and certainly more productive over the whole summer.

Methods of sowing to-day represent less striking advances over those of twenty years ago, but sowing down with oats or wheat is rarely seen now, and except on the larger farms sowing down with turnips is less practised. That is to say that the common method is to sow with rape, and the crop rotation is planned with this end in view. One system which I have been recommending widely is the drilling of cocksfoot to ensure its rapid establishment; this can be carried out without any extra trouble by mixing the Cocksfoot Seed with the manure (using of course an insoluble fertilizer) drilling through every coultar with tha rape through every alternate coulter and' the rest of the mixture broadcast. There is considerable scope for study of methods of sowing both on land that has been ploughed and on land that is being surface sown.

PROBLEMS OF MAINTENANCE.

Under this heading would properly come the problems of cultivation'and manuring of established pastures. The necessity for thorough cultivation of pastures, particularly dairying pastures is now widely recognised and implements for this work have been very considerably improved without yet attaining perfection. In many cases the best results are gained by what would appear to be the most drastic treatment, a rigid-tine cultivator with narrow points sat in deeply, this however, is of rather heavy draught for horses and a tractor is necessary. Most types of special grass-harrow are efficient under certain conditions, but for Southland and South Otago generally a heavier implement is more to be recommended. The top-dressing problem was briefly touched on earlier, and I would only add here that a great deal of judgment must be exercised not only in regard to the best fertilizer to use 'but also in regard to time of application and,to the type of pasture from which results can be expected. With first class pastures (of which we will have many more in the near future) I believe that 'there will ultimately be adopted a system of manuring more balanced than that found satisfactory enough to-day, and that a considerable increase in the practice of autumn application will come about, At present almost the whole of the fertilizers used in the South are applied during the Spring and early Summer, yet evidence is not wanting that an Autumn application can prove highly profitable.

With other problems of maintenance must be considered the prevention of succession of pastures to less desirable species - brown top, sweet vernal, fog, daisies, rib-grass, moss, fern or' manuka scrub to name only those most commonly seen. Time will not permit discussion of these succession species individually, but. as practical illustration we might further consider the brown-top problem, *since* during the past few years there hns been much attention directed to its "invasion" of permanent and long-rotation pastures even on first class land, Since it is quite a lot better than bare ground or moss we. should hardly complain of its taking possession of ground which we leave open for it. The elimination of brown-top depends first of all on clean ploughing of the old lea zither by skimming followed by deep-ploughing or by use of the digger plough with *skim* coulter; the after-cultivation should not bring any of the old turf up and strike-outs should be closely covered. The land should be kept clean while under crop and when sown down a gross mixture used which will form a close and lasting sward bringing us again, of course, to the perennial rye. Heavy seedings of dogstail have been recommended to "keep out" brown-top and with some justification since the dogstail turf in the wetter districts is closer and more lasting than false perennial, but with ths introduction of true' perennial a different complexion is put on this prablam. Given a close sward of true perennial, cocksfoot end. clover, the maintenance of surface fertility with moderate top-dressing will effectively prevent brown-top invasion.

Yet another problem of maintenance is the control of the grass grub and Subterranean caterpillar not';: receiving attention from our entomologists.

PROBLEMS OF UTILISATION.

Faulty utilisation of pastures is a frequent cause of loss as well as a contributing factor in deterioration. Under-grazing or over-grazing can each bring about undesirable results. In the South we see very little of two practices now very common in the North Island - early mowing of pastures and ensilage making. The reason is that generally speaking there is no great surplus of feed during early summer and the extra stock being carried. (i.e. the lambs) at this season practically keep pace with the growth on the average pasture. The better pastures usually outgrow the feed requirements and provide a surplus for hay or ensilage.

In conclusion I would stress the supreme importance of continuing and extending research work on all problems relating to grass-land improvement, the importance too of the educational side particularly with young farmers not only to import to them knowledge of improved methods but also to stimulate their interest in their most important crop and its infinite possibilities and to give them that vision without which in a very material sense "the people perish", Fifty years ago in Britain, Latham wrote:-

"When we further consider the number of breeding ewes maintained, and the amount of mutton and wool which our Scotch mountains annually produce, it is not difficult to perceive that they are undergoing a process of impoverishment - in other words, are in the course of being slowly but surely robbed of many fertilising properties, especially of their phosphates, and that to such a, degree as (without remedy) must, in course of time, render them Comparatively unproductive."

It may well be asked', "Does the New Zealand hill country under consideration in any important respects parallel the Scottish?"

Then again hill country breeding flocks depend upon an annual importation of rams bred under special conditions. Stud breeders aim at early maturity and desirable shape of carcase as well as wool, and' there has been a steady infusion of these characteristics into hill country flocks. Now the larger the sheep and the more rapidly it matures the greater are the demands on the pasture. It has thus occurred that the demand on the pasture has become increased by selective stock breeding at the same time that the soil - reflected through the pasture - is being progressively depleted and exploited.

Following this train of thought has one justification for questioning whether the sires used at present are best adapted 'for mating-with our hill country ewes depasturing on a type of country which is trending towards a lowering fertility.,,

. As an oxamplc of fitting the breed to'the'country and assisting the pastures of that country to fit the breed, we have the classic example of the New Zealand dairyfarmer in the intensive dairying districts of Waikato and Taranaki, who;. from. experience has chosen a light onergetic, high-yielding breed into which he ha's infused sufficient stamina by crossing to give him a very' profitable producer, suited to the particular environment of his district, while at the samo time he has successfully lifted the production of his grassland to suit the breed he has evolved.

Personally, I feel that the future improvement of hill country sheepfarming will be a combination of feeding and breeding and of the two I feel that the management of hill country pastures easily presents the greatest problem in New Zealand today.

From my own observation it seems to me that leaders in the sheep industry today talk incessantly of breeding but seldom of feeding. Is tho problem of improving or even holding the hill country grassland so great that it cannot be faced?

I feel that there is an urgent call for vigorous investigation in the hope that some mothod of management may assist in improving those pastures.

Pasture improvement seems to centre round manuring and unfortunately at the present timo many immediately jump to the conclusion that topdressing cannot be economically sound, yet one has some evidence that this may not be necessarily so in all instances. The following example is at least interesting:-

T. H. Verry, Konini, pahiatua.

Area 600 acres, all low hills originally bush (probably 30 to 35 years old .)

Previous to 1927:	Carried:	300 breeding ewes
		200 hoggets
		100 wethers
TOTAL:		600

Lambing 80% highest figure.
No fats.

Started Topdressing 1927:

1927	used	18 tons	fertiliser:	20 bales	(wool grown previous year.)
1928	"	24	"	20 "	(probably not fully stocked up.)
1929	"	30	"	28	bales.
1930	"	28	"	31	"
1931	"	14	"	32	"
1932	"	21	"	29	"
1933	"	18	"	32	"

Another farmer in this neighbourhood has an:-

Area of 400 acres felled about 25 years.
Present ownership since 1915.
No topdressing at any time.
1915: carried 1100 sheep (half ewes and half hoggets.)
Everything fattened at that time.
1933: carries 750 sheep (half ewes and half hoggets)
Practically nothing fattened.
Country appears to have been going back gradually all the time.
Lambing remained about the same, - 85% to 100%.

The trend of thought up to the present in this paper is the welfare of the breeding- ewe. Next in importance to the improvement of the pasture for the breeding ewe, comes the problem of raising the standard of pastures responsible for the health and proper growth of the ewe hogget which in turn is the foundation of the hill flock and, later of the low country fat lamb.

It is an accepted fact the world over that, defective feeding of the young animal is reflected later in life. Several years ago the Rowett Institute carried out an extensive investigation of the mineral content of cultivated and hill pasture. It was found that the mineral content of the hill pastures was much less than that of cultivated pastures. Subsequent work also indicated definitely that lack of lime or phosphate or both may eventually detrimentally affect the breeding capacity of the female and result in a lowered lambing percentage.

As a New Zealand instance of this aspect the following is of interest:-

As a result of correspondence, representative members of the East Coast Sheep Owners' Union met me at Gisborne on August 30th, 1931, and explained that their Union desired the Department of Agriculture to investigate:-

1. The decreased carrying capacity of their hill country during recent years.

2. The lowered Lambing percentage in certain localities. It was contended that the lambing percentage had been gradually lowering over the past ten years.

It seems unsound to expect a high-priced, well-bred ram to leave a permanent imprint of special breed characteristic on the flock if we are not prepared to provide the young growing, ewe hogget with good nutritious pasture.

If this is so, the fundamental problem seems to be by what method can the hill country sheepfarmer through the ewe hoggets carry on with a progressive breeding policy and hope to hold the quality and fertility of his breeding flock. The natural answer is by virtue of a nutritious pasture, and it seems very clear that the only practical method is through the manure bag.

The hogget position is not new if one reflects on what happened in the early history of a large proportion of this type of country. In the beginning, when the pastures were luxurious and nutritious, the Romney breeding flocks were infused with a heavy proportion of Lincoln blood.

As pasture conditions changed the rearing of Lincoln-Romney hoggets became increasingly difficult and the sheepfarmer said "They died like flies." A forced change in breeding came about and the Lincoln infusion had to be eliminated for the very good reason that the Lincoln-cross hogget could not stand up to a lowering pasture standard. Hence the later change to straight Romney.

To return to the hill country pastures which are responsible for the breeding, flocks - the following suggestions are brought forward for your consideration, and, in doing so, one hopes to give 8 lead to discussion on the subject rather than to suggest that the method is a solution of the problem.

Wherever practical, fertiliser should be applied and whether it is applied or not, the method of management at all times should include sufficient cattle as agents in grazing management. Apart from the hogget pasture, and where manuring of the whole farm is not practicable, it is suggested that a system of "deferred rotational grazing" or in other words the practice of shutting up a certain proportion of a holding completely during the period of the year when the most vigorous grass growth occurs, should be considered with the idea of allowing thebetter pasture species to recuperate and strengthen.

The following is a tentative, outline of the deferred rotational grazing: It would probably be important that the time of closing a block be as soon after 'spring growth begins as possible and convenient, commensurate with the efficient management of the stock on the remainder of the property.'. The' grazing of the spelled block would be deferred until it had passed through a complete growing period including the drying off of the growth. It would then be,. rapidly cleaned up by the cattle and after a further short spell autumn growth would permit of the usual winter stocking. If further improvement were necessary and sufficient invigoration had not. occurred, and providing no troublesome secondary growth was in evidence it might be found advisable to close again in the second season, or if reasonable improvement had occurred then the system would be applied in rotation over other blocks and carried on continuously. On many of the better type hill aountry pastures there are still remnants of cocksfoot, dogstail and trefoil, and even weakly plants of white clover and ryo in places. The spell and shads would strengthen many of these that yet remain, and it is suggested that tho general: effect would be good. Such deferred rotational grazing is possible by virtue of the fact that it would 'occur at the season of' the yoar when a block of Pasture can best be spared, and the spelled pasture after cleaning up is still in time to benefit 'from autumn growth and come into action again for winter stocking.

It cannot be claimed that of the two methods mentioned, i.e., "Manuring" and "Deferred rotational grazing" that the Latter is to be preferred: Theoretically, the first method is undoubtedly the better since the animal receives the necessary mineral matter in a natural and most readily assimilable form and should certainly be employed, where it can be shown to be economically sound, 'but where this is not possible a method of spelling may be beneficial in conjunction with the use of mineral Licks. From work now in progress under the direction of the Rowett Institute it is claimed that "the effect of mineral feeding is cumulative., each succeeding generation is better able to carry a Lamb and milk it, and It is confidently stated that proper feeding will increase the productivity Df hill stock; that it will decrease the d oath rate and increase the birth rate; that it will result in more lambs being raised as hoggets and that these hoggets will be of greater size and value; that it will increase the wool clip and the value of the cast ewes, "and we may add the value of 'the fat lamb 'export to New Zealand."

Except perhaps when a sale of the land is in view, many of the holders of the hill country under consideration will freely voice the opinion that the country in general still continues to fall.112 carrying-capacity, and this is an opinion generally held, but it is difficult to ascertain whether this opinion is justified by actual facts I. District statistics and even individual farmers' statistics do not necessarily throw reliable light upon the' position. This is because the figures; for hill country are frequently inseparable from the figures for neighbouring level country, and it is impossible to be sure that increases in the latter have hot offset decreases in the former. Even if the position is better than many believe, even if the hill country generally is not still deteriorating as many who are farming it hold, yet the welfare of the North Island hill pastures seems to have every likelihood of growing in importance chiefly because the economic position of the North Island fat lamb industry and to some extent that also of 'the South. Island is dependent upon hill country productivity. Judging from the light thrown 'during the past dozen years upon the relation between pasture management of the Low country and its carrying capacity there seems no reason provided, the price of fat lamb continues as good. as it promises to be in the coming season, why within the next dozen years the annual output of fat lambs should not increase by two or three millions so long as a sufficient number of suitable mothers are, available at a price which would make the raising of additional lambs worth while. The question which at once arises is, will the required breeding ewes be available at an economical price unless there is improvement in the carrying capacity of 'the hill country which is, the present 'source of supply.

When the possibility of improvement 'of the hill country production is being studied, the methods that have assisted in bringing about increased dairying production seem to be worthy of consideration. Much of the progress that has been made in dairying has been attained by studying the grass farming methods and allied practices of the dairy farmers obtaining good results, and then by disseminating effectively the knowledge thus acquired among the great body, of dairy farmers. It seems very Likely that a parallel,' procedure in respect to the Sheep farming of the hill country that previously carried bush would be productive of valuable results. Some-work, of course, has already been done along these lines but it has not been possible to make-it as intensive 'as has been the corresponding work in the dairying world.

Work along other Lines might even prove advisable, but, if so, it would almost certainly, develop out of work which as suggested would parallel 'that which has served so well in dairying. . . .
