RÉSUMÉ OF ADDRESS ON THE USE OF FERTILIZERS ON GRASSLAND AND THE TECHNIQUE AND SCOPE OF EXPERIMENTAL WORK.

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The Use of Fertilizers and Lime:

The figures quoted below in regard to the use of fertilizers and lime refer to the 1929/30 season, unless otherwise stated.

Superphosphate:

Two hundred and three thousand tons of super were used on 1,761 ,000 acres of grassland; equal to 2.3 cwt. per acre.

Basic Slag:

Eighty thousand tons of slag were used on 651 ,000 acres of grassland; equal to 2.5 Cwt. per acre.

Other Artificial Fertilizers:

Fifty thousand tons of artificial fertilizers other than super and slag were used on 441,000 acres of grassland; equal to about 2.3cwt. per acre.

Lime:

One hundred and seventy-one thousand tons of lime were used on 360,000 acres; equal to approximately 9.5 cwt. per acre.

The total sown grasslands of New Zealand equal 17,000,000 acres. Allowing that "other artificials" were used on land distinct from that receiving super and slag (much of it would be used to supplement phosphates) we find a total of 17% of our sown grassland was manured in 1929/30. Obviously, this is only a small proportion of the, grassland on which manuring is profitable. All sown grassland will not respond to a paying extent to manuring, but much more than 17% should be manured annually. The total manure used works out at the rate of 0.39 cwt. per acre for 17,000,000 acres.

Lime was used on about 2.1% of our sown grassland, Over all, the quantity used represents 0.2 cwt. per acre.

When it is remembered that our most successful dairy farmers in the Waikato and Taranaki particularly are using 6 or 7 cwt. of phosphatic manure per acre per annum, it is obvious that the greatest proportion of our farmers are playing at using fertilizers and lime, or are not using them at all. In spite of this, however, the export of butterfat has practically doubled during the last ten years. Much of this increase is definitely attributable to topdressing of pastures. Fawcett has shown that production costs per pound of hutterfat decrease with increased use of manures.

Existing definite knowledge regarding Soil Responses to Fertilizers:

Generally speaking, practically all New Zealand soils respond to phosphates and nitrogen. The chief difficulty so far as the latter is concerned, is the determination of its economic value. Practice has already shown phosphates to be paying in the great majority of cases. Lime is in a less satisfactory position. Except under conditions of high response its effect is often difficult to observe, but the fact that it is likely to have an important bearing on the health of stock seems to render its use desirable pending the gaining of further knowledge regarding its use in New Zealand. Potash is in a particularly unsatisfactory position in that its use has often been deprecated in a general way without justification. There are undoubtedly soils which are as deficient in potash as in phosphate, particularly in North Taranaki and Southland, as exemplified by the response to applied potash. Obviously its need is not so widespread as is the need for phosphate, but is very acute in some districts.

There is an urgent need for what may be termed a "manure-response-survey" of New Zealand to enable soils responsive to an observable extent to lime, phosphate and potash to be mapped out.

How to get Information rapidly regarding Soil Deficiencies as indicated by Improved Pastures when treated with Fertilizers and Lime:

It is suggested that a series of at least 2,000 observational experiments should be laid down throughout our sown grasslands. Lime, phosphate, potash and nitrogen, each alone and in combination, should be used. A series of such experiments was carried out in Canterbury in 1928 to 1930. Information which would take a lifetime to gather by ordinary observation of farmers' practices, was gathered in two years. The most outstanding feature of these trials was the almost universal response to lime, and more especially to lime plus superphosphate. On land normally regarded as "sweet" lime plus super was outstanding in its effect, and almost invariably superior to lime or super alone. Potash prove&/of little value so far as could be observed, except in about 5% of the trials. Nitrogen was effective in practically all experiments, but unless used with lime plus super or super it often had rather undesirable effects on botanical composition of pastures,

The lessons'learnt in Canterbury are already bearing fruit. In 1928/29 about 7,000 tons of lime were used in Canterbury. Denoting' this as 100, the relative amounts used in 1929/30 and 1930/31 were 180 and 233 respectively.

This increase in the use of lime in Canterbury coincided in 1930/31 with a general reduction of 26%, as compared with'the previous year, in the use' of lime over the South Island as a whole'.

It is not suggested that observational experiments would provide a measure of the economic value of applications of lime and manure, but in a large number of cases results from one treatment or another, or combinations of treatments would be so outstanding as to leave no doubts regarding the economic value of'such treatment or treatments., In other cases responses would be apparent but of doubtful economic value. These would necessarily require more detailed investigations. Others again would show no observable effect from applied treatments, and even though eye estimation of effect was not sufficiently discriminating in such cases, it is reasonable to assume that those treatments, the/effect of which could not be detected, would not be really important factors in production..' The main point is that much useful information can be gained quickly and cheaply, whereas at the present time we have no information regarding the effect of some fertilizers at least.

The "manure response survey" is being pushed ahead as rapidly as limited finance will permit by the Department of Agriculture, but at the present rate of progress it will take many years to carry it to a successful conclusion.

In addition to a knowledge of what soils respond to different soil amendments, much detailed information on rates, times and frequency, etc., of application of manures and combinations of manures and lime and their effects on soil and pasture herbage is urgently needed.

Method suggested for acquiring more explicit Information regarding Effects of Manures, etc.:

Three chief methods are open:-

a By stock grazing trials.
b By haying trials.
c By mowing -cum grazing trials such as are being conducted at Marton at the present time.

Stock grazing trials have the objection that they require large numbers of stock and large areas of land. Hence experiments become very costly, and results may be nullified by stock ailments having nothing to do with the treatments under trial.

Measurement of production of hay is unsatisfactory because it measures the production which occurs during high production period, which is the least important. There are other objections which need not be mentioned here.

A technique for the measurement of herbage produced by a pasture. which is giving highly satisfactory results, has been evolved at the Marton Experimental Farm. This involves the cutting and weighing of successive growths of grass with a lawn-mower. The disadvantages of straightout mowing and its effect on the removal of nutrient material from the pasture as well as the profound effect it had in changing the botanical composition compared with tie same pasture under grazing was explained. By having duplicate areas, one of which was under mowing while the other was under grazing, and vice versa, it had *been* possible to maintain a botanical composition of the pasture practically identical with that of an intensively rotationally grazed one. Further, the whole of the herbage was consumed. by stock on the area on which it was grown. The technique was fully described in the Journal of Agriculture for August, 1931, and a series of reports on various investigations is in course of preparation for publication.

I am strongly of the opinion that a large number of our grassland problems' can be solved satisfactorily by adopting the above technique, Moreover, a high degree of accuracy can be attained at a comparatively small' cost.

In order to get information on similar and different problems I consider five *or* six stations should be established, one in each of the main grassland centres of New Zealand. The Waikato, Taranaki, Wellington, Canterbury and Southland would make good starting points. Each area could be equipped at a cost of about El ,000 and would- cost about the same amount each year. Only 15 to 20 acres would be required at each centre.

Certain general principles worked out under one set of soil and climatic conditions may or may not apply under another set of conditions. Only their investigation under varying conditioris can determine this. It is certain, however, that the investigation of such things as quantities, time of application and methods of application. of a particular manure should be attempted only on a soil type known to be responsive to that manure. It 'would be wrong, for instance, to endeavour to investigate various aspects of the use of potash at Marton, for although there is a definite response to potash at Marton, it is not sufficiently marked to warrant detailed study or to encourage 'the idea that reasonable differences could Se got from different quantities or methods, etc., of application. On the other hand, North Taranaki or Southland would appear ideal for such work because of the marked response to potash and the inter-dependance of phosphate and potash in these districts. Such stations would provide centres from which the manure response survey already mentioned could radiate and at which standards for judging effects by eye could be more or less decided on.

Expenditure on Grassland Research':

Something like 6d. to 1/- per £100 value of our grassland exports is being spent in grassland research. When the importance of grassland is considered and the small amount compared with what is being spent on research into other primary industries, it is obvious that there is enormous scope for development of grassland research.