

NUTRITIVE VALUE OF SOME HIGH-COUNTRY PASTURES

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Most of the observations and research work carried out to date on the high country of New Zealand have been concerned with the maintenance of the existing pasture cover or of regeneration in depleted areas. This line of work is obviously a most important one, but it should go hand in hand with a study of the animals grazing those pastures. This paper is concerned with an attempt to bridge the gap between the plant and the animal, by chemical analysis of the pasture to determine its value to the grazing sheep.

Much work has been done on the food value of highly improved pastures of the ryegrass-clover type on the topdressable dairy and fat lamb country. Such pastures have been shown to be of exceptionally high value, being highly digestible, and containing ample protein, calcium, and phosphorus. By contrast our knowledge of the hill country is extremely limited. The only data available are Aston's analyses on pastures from some areas in the Wairarapa and Poverty Bay, and Rigg and Askew's survey of some hill pastures in the Nelson district, all done over 20 years ago. The most important feature of this work was the low phosphorus content of some Wairarapa pastures—levels down to as low as 0.09 per cent. of phosphorus in the dry summer—and this was associated with phosphorus deficiency of the stock. As far as I am aware, no chemical analyses have been reported on the pastures of the high country and the work to be described was undertaken to extend our knowledge in that direction.

Our work at Lincoln has been along the following lines :-

1. A preliminary survey of South Island hill country and high country pastures in regard to their chemical analysis.
- II. Analysis of individual species taken from Grasmere Station in the high country.

III. Analysis of individual species taken from a North Canterbury Catchment Board enclosure in the high country near Lake Coleridge.

The generally accepted standards of minimal requirement for a lactating ewe, expressed as percentage in the dry matter of the feed, are as follows:—Protein, 10 per cent., calcium, 0.25 per cent., phosphorus, 0.25 per cent. The dry ewe, pregnant ewe, and growing hogget require rather less than these amounts, probably protein 8 per cent., calcium 0.18 per cent., phosphorus 0.18 per cent. In the hill and high country of the South Island the ewe is suckling the lamb from October to February or March, and most of the analyses were made during the ewe's lactation period.

I. SURVEY OF HILL AND HIGH COUNTRY PASTURES

Mixed pasture samples were obtained from 22 different localities in the South Island from Nelson to Southland. The first, called the summer sample, was collected in January or February, 1950, at the end of a very dry summer. Most of the material was dry and stalky. A second sample, called the spring sample, was obtained in October-November, 1950, that is, in the spring or early summer. This sample was generally green and leafy, though sometimes with stalk and flowers.

None of the localities had ever been limed or top-dressed with superphosphate. The dominant pasture species were sweet vernal, browntop, and danthonia in that order, with occasionally a little white clover. Of the 22 localities sampled, 4 could be described as high country tussockland, 2 were plainsland, and the rest hill country. The results obtained were as follows:—

1. **Protein.** The spring samples were generally satisfactory, but the summer samples were invariably bad with an average of only 7.6 per cent. crude protein.
2. **Calcium.** Calcium levels were generally satisfactory, varying from 0.20 to 0.66 per cent.
3. **Phosphorus.** Excluding Banks Peninsula, where the levels were quite high, the mean phosphorus levels of the pastures in spring and summer were 0.24 and 0.13 per cent. respectively.

4. Copper. The copper levels varied from 3.0 to 10.7 p.p.m. with one third of them below 5 p.p.m.

Digestibility trials were conducted on mixed pasture of blue tussock, browntop, and sweet vernal from Grasmere in spring, summer, and winter. The protein contents were in the region of 5 to 6 per cent., These showed the digestibility of organic matter to be below 50 per cent. and the nutritive ratio to be worse than 20:1.

II. CHEMICAL ANALYSIS OF INDIVIDUAL SPECIES FROM GRASMERE

A north-westerly face at an elevation of about 3000ft. near the Grasmere homestead in the Waimakariri Valley was chosen. The rainfall in this area would be in the neighbourhood of 50in. Individual species available there were collected in February, June, and November, 1950, to give summer, winter, and spring samples. The species analysed were fescue tussock, blue tussock, browntop, sweet vernal, Yorkshire fog, white clover, and catsear.

These analyses have shown (i) that the two tussocks are deficient in protein, calcium, phosphorus, and copper at all times; (ii) that in the three grasses only the spring samples can be considered satisfactory. The summer and winter samples are deficient in protein and phosphorus; (iii) white clover and catsear have approximately the same composition and are satisfactory at all times. In comparison with the grasses they contain roughly double the protein, four times the calcium, and 50 per cent. more phosphorus and copper.

III. CHEMICAL ANALYSES OF INDIVIDUAL SPECIES FROM LAKE COLERIDGE

The next series of analyses were made from a 2½-acre enclosure of the North Canterbury Catchment Board above Lake Georgina, near Lake Coleridge. The altitude is about 2000ft., the aspect northerly, and the slope fairly steep. The enclosure was not grazed.

Samples of individual species were collected about the middle of the months of October, November, December, January, and April of 1951-52 and this covered the growing season.

An outstanding feature of the observations was the exceptional earliness of sweet vernal and the relative lateness of Yorkshire fog. For example, sweet vernal came into flower at the end of October, dan-

thonia and blue tussock in December, but fog and catsear did not flower until January.

In a considerable number of instances leaf and stem were analysed separately. The protein and mineral contents of the leaves were higher than those of stems, but not greatly so, so that selective grazing of the leaves would make the position only slightly better.

It will be observed that the grasses, sweet vernal, danthonia, and fog are deficient in protein at all times except early spring. Calcium levels are satisfactory. In phosphorus catsear, hawkbit, and suckling clover are satisfactory, but the grasses can be considered satisfactory only in early spring and by summer they are deficient. Similar species differences are observed in copper status. Some samples of plume grass: *Agropyron scabrum*, sorrel, and carmichaelia were also analysed, but they showed nothing to make the picture any brighter.

The data presented from all three sources indicate that an apparent deficiency of protein and phosphorus exists in our hill and high-country pastures at most times of the year except in spring. There are no outstanding differences between the different species of grass, but catsear and clovers are much higher than the grasses in protein, calcium, phosphorus, and copper and can be considered satisfactory.

CONCLUSION

On the lowland topdressable country one can say that the sheep or cattle eat practically everything that grows. Under conditions of sparse grazing such as we have in the hill country and high country where early summer growth gets away and where there is also a wide range of species present, it is very much more difficult to determine what the animals eat. Cockayne showed some 30 years ago that there are considerable differences in palatability between different high-country species. Until more is known of what the sheep eat one must be cautious 'in making deductions from analyses of pasture collected' by man. We have collected and analysed the material that was there to be eaten. Most of it is eventually eaten, but when and at what stage of growth are not certain.

If we take a reasonable approach to this and assume that the sheep do eat sweet vernal, danthonia, browntop, fog, catsear, and clover and if our sampling can be taken as reasonably representative, then it is

clear from our analysis that the nutritive value of our South Island hill-country and high-country pastures is exceptionally low and of an entirely different order from that existing on improved country. Nevertheless, sheep do live on this country. Unless the sheep requirements of, for example, protein and phosphorus are wrong, it follows that the sheep on such country can so reduce their rate of growth, wool production, and milking capacity that they can adapt themselves to the poorness of the feed. Possibly by selective grazing their diet is rather better than has been indicated, but if it is, there must be a large wastage of material which is never eaten.

, How can the diet be improved ? The following suggestions are made, some of them, I know, uneconomic, but at least technically possible:—

1. Grow or purchase high-protein feed such as lucerne or clover hay.
2. Establish clovers which would improve the protein, phosphorus, and copper intake, but, more important still, provide the nitrogen to make the grasses grow better.
3. Increase the amount of flatweeds (catsear and hawkbit) in the country.
4. Find some exotic high-protein, high-phosphorus shrub or plant which is edible and will grow in the country.
5. Introduce through better subdivision a system of controlled grazing whereby the grasses are eaten in the leafy stage before the rapid decline in nutritive value sets in.
6. Encourage a mixed grass sward with the later maturing species such as fog so that leafy material is available over a longer period.
7. Complementary grazing.

One should not deduce too much from this paper. The uncertainty as to exactly what the sheep eats and as to what its requirements are in such an environment, necessitate that one look at the overall picture. Further, the work is merely a rough survey to determine whether there are any outstanding features which might require closer investigation. Obviously there are.

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