

*Mairoa "Dopiness," or Calcium Deficiency.*

The investigation of any deficiency disease in domestic stock is best studied in three different directions, with the object of ascertaining how (1) the soil, (2) the pasture, (3) the animal, differ from the normal, and each of these three factors should be studied separately to determine how far each departs from the normal.

In the case of the air-borne volcanic showers of fine material which form the typical soils of the Mairoa district and many other areas an initial study of the mechanical and chemical composition of the soil brings out certain abnormalities wherein the soil differs from that of average hillside upland sheep-pastures of the North Island. These are—

- (1) The very high "lime requirement" by the Hutchison McLellan method—roughly, about 10 tons per acre.
- (2) The very high organic matter content—20 to 30 per cent. ;
- (3) Exceptionally porous nature.

The soils belong to the class called "loams," which are recognized as fertile soils ; hence it is probable that normal returns may again be expected under suitable treatment. In these three particulars the Mairoa soils, and probably all similar fine-grained volcanic soils with a similar history, are an exception to the ordinary poor upland sheep-runs, and it may be in the study of these divergencies that a clue will be found for the failure of the herbage to sustain normal growth in the animals thereon depastured. That the soil exhibits, in common with other soils put to a like purpose, similar deficiencies (*e.g.*, phosphoric acid) does not help much, seeing that similar deficiencies occur on all poor hilly country where disease does not develop.

- (1) There can be no doubt of the excessively high lime requirement of the soils in this district.
- (2) Regarding the high organic matter content, it is difficult to assess the effect, but such soils are usually responsive to lime dressings.
- (3) The porous nature of the soil making this subject to excessive leaching, is further evidence that lime is highly necessary seeing that lime is a mineral substance lost from soils in very large amounts.

In experiments at Rotorua with a very coarse pumice soil treated with superphosphate, no phosphates could be detected in the drainage effluent. Joachim ("Peradenya Drainage and Leaching Trials," *Tropical Agriculturist*, Vol. 73, No. 5, 1929, p. 271) says, "No phosphoric acid appears to be lost in the drainage-waters of Ceylon soils."

Hendrick ("An Account of the Craibstone Drain Gauges," *Trans. Highland and Agricultural Society*, Vol. 33, p. 76, 1921) states : "Yet so well is the phosphate held by the soil, that practically none of it is washed away in the drainage."

It may therefore be taken that not only is there great deficiency of lime in the Mairoa soils, but that this deficiency is progressing both at Mairoa and on other soils more recently cleared and grassed ; so that the experience gained at Mairoa may be expected to occur elsewhere in course of time. It must always be remembered that the initial history of Mairoa was highly favourable to the use of that type of country for sheep, but that after some years' stocking the country did not improve as does the typical bush-sick pumice country ; on the contrary, progressive deterioration set in and its utilization as sheep-country became unprofitable. Something evidently was comparatively rapidly leached out of the soil, and that this something was lime, there is much circumstantial evidence to prove. It may therefore be taken as proved that the crying need of this country in order to make the soil more normal is lime carbonate or some other form of calcium. Experiments have been on limed and plastered paddocks—*i.e.*, paddocks treated with carbonate of lime and gypsum (sulphate of lime)—upon which culled hoggets from a near-by farm, but one much more sheltered and having a better pasture, were pastured for two years. The results showed a distinct improvement in the health and development of the stock, due to the use of both limestone and gypsum. It is to be hoped that arrangements for the continuance of these experiments may be effected during the coming months.

The analysis of the pasture provides the second class of criteria which must be examined in investigating the deficiency diseases ; and this is a more difficult direction to explore, owing to the fact that one is dealing entirely with living matter which is changing in chemical composition all the time with the climate and season, with the stage of growth, and with the botanical composition. Nevertheless, the analyses of the Mairoa pastures do show an abnormally low calcium content at all seasons of the year, and when these pastures are top-dressed with calcium carbonate they do, if the samples are properly taken, show an appreciable increase in calcium content. The entire absence of leguminous constituents in the untreated pastures upon which the malnutrition develops is further evidence of calcium deficiency, since legumes are the characteristic lime-winning plants in a pasture normally containing from two to three times as much calcium as the grasses contain even on unmanured land.

Finally, the composition of the animal may be studied, or, what is more to the point, the physiological symptoms. This is a very special department, and the technique is as yet poorly developed and very difficult to carry out. That this is realized by the authorities is shown by the importance attributed to the analysis of pastures. Were it possible to determine from an analysis of blood, for instance, from what particular deficiency the animal is suffering, and any reliance could be placed on the result, the lengthy and laborious gathering and analyses of the pasture-samples could be largely discontinued.