

The three outstanding instances of this deceptive nature of the pasture are (a) "bush sickness," or iron starvation in sheep and cattle; (b) "dopiness" in sheep, or calcium starvation; (c) "Waihi disease" in cattle, or phosphorus starvation. (It is possible that this phosphorus deficiency may occur in sheep also in some localities.)

The bush-sick pasture has not only misled hundreds of practical farmers by its apparent normality and luxuriance of growth, but quite recently two eminent British authorities have failed to see anything abnormal in the appearance of the pastures. The Mairoa "dopiness" pasture after treatment with a calcium salt is still a poor-looking feed, yet the addition of calcium has enabled a flock of young sheep to be maintained in health for eighteen months where previously the mortality would have been heavy. Some cow-pastures in the upper Wairarapa district carrying a fair proportion of clovers and having good lime percentages are yet extremely deficient in phosphorus—none worse, indeed, has yet been found in New Zealand. Other areas are affording similar evidence, but sufficient work has not been done to enable much to be said on the composition of their soils or pastures.

The remedy for each of the three troubles in stock mentioned is different; but it may be at once said that, as all North Island soils are deficient in phosphate and give a liberal growth-response to phosphatic treatment, each of these deficiency diseases is benefited to a certain extent by phosphate dressings. Indeed, it would be an extraordinary thing if it were not so, seeing that phosphates have such a stimulating action on all plant-life—increasing the root-development and the consequent ability of the plant to search further afield for plant-food, and increasing the proportion of clovers in the pasture, thereby increasing the calcium content. Also it must not be forgotten that in the case of superphosphate other mineral foods besides phosphorus are supplied, chiefly calcium sulphate (supplying Ca and S); while in the case of basic slag there are supplied iron, manganese, silicon, calcium, and magnesium. All deficiency areas are therefore likely to respond to liberal phosphatic manuring, and especially to treatment with a basic-slag and superphosphate mixture in equal amounts. It may be noted that basic slag is the only commercial phosphate which contains iron in appreciable quantity.

In regard to calcium deficiency, there are cases where the application of lime or calcium salts does not increase to the same extent as phosphates the carrying-capacity of the pasture (Wallaceville experiments gave evidence to the contrary), yet it undoubtedly makes it more palatable and has a great influence in rendering stock more resistant to disease; therefore calcium salts or lime may well be advocated as a pasture-dressing. The administration of licks to combat calcium deficiency is still in the experimental stage.

One of the greatest difficulties met with in the progress of this investigation has been that of obtaining samples of pasture which adequately represent what the animal is actually eating. The most misleading results may be obtained from pasture gathered in the field on which stock are actually grazing.

Mamaku Experimental Farm.

Field experiments under the direction of the resident overseer of the Mamaku Farm, which is situated in the centre of the bush-sick area of the Rotorua district, have been continued, and the results are summarized as follows:—

Experiment 1 was to determine to what extent frequent top-dressings with iron phosphatic manures would enable the sandy-silt soil of the Mamaku area to maintain sheep successfully. On the 23rd November, 1927, ten vigorous large-framed type wethers in very forward condition and fit for slaughter were put on No. 11 paddock (27 acres), which had previously been top-dressed with sulphate of iron $\frac{1}{2}$ cwt. per acre, gypsum $2\frac{1}{4}$ cwt. per acre, and superphosphate $1\frac{1}{4}$ cwt. per acre. An additional top-dressing of $\frac{1}{2}$ cwt. of Ferrous sulphate per acre was applied in 1928. The sheep did quite well up till the 4th February, 1929, when one died in good condition, the cause of death not being ascertained. The remaining nine sheep were transferred to a young-grass paddock free from ragwort, and a commencement was made with the feeding of pellets to all the sheep except one, which, being poorer in condition, was drenched with $1\frac{1}{2}$ oz. 6 per cent. solution of Ferri ammon. cit. As late as June, 1929, it was reported that the sheep, although poor in condition, were bright enough, and were taking the pellets readily. The composition of the pellets is as follows: Iron ammonium citrate, 2 lb. 8 oz.; copra, 24 lb.; flour, 16 lb. 4 oz.; peanut-meal, 9 lb.; cod-liver oil, 2 lb. 8 oz.; anise, to flavour.

The efficiency of iron sulphate as a dressing for coarse pumice soils to supply deficient iron is very questionable under soil conditions of high aeration and low humus content. In other cultivated soils, more compacted and containing more organic matter, ferrous sulphate appears to give better results, as a pasture-dressing, on the health of the stock.

Experiment 2: An experiment with steers on the same paddock as the sheep gave results which indicated that some unusual influence was at work which militated against the proper development of the cattle. The new factor was suspected to be poisoning due to ragwort, as the animals had been observed eating that plant. The matter is now being tested by a straight-out experiment.

Pellet-making.

The two experiments in which the feeding of pellets (consisting of half oily meal and half mineral foods) to sheep were successful in restoring bush-sick sheep to health having proved the efficacy and adaptability of the method, the use of this has been extended. During the year over 12 cwt. has been made up and despatched for various experiments in the country. It is anticipated that this method of combating deficiency disease in sheep will prove superior to others in the case of animals grazed on broken or hilly land of a character similar to that of parts of Scotland where the method was first successfully used by the Rowett Institute in the cure of sheep suffering from mineral deficiency in their natural food—poor pasture. In New Zealand sheep have in the past been found to be particularly difficult to treat for bush sickness, being far more susceptible than cattle to this form of malnutrition, and, when found to be suffering, are usually too far gone to drive long distances to change paddocks on healthy country, while drenching a large number of animals daily for a few weeks is not practicable.

Investigation is being made into more efficient and economical methods of producing the pellets.