

in treating both cattle and sheep. The difficulties in obtaining iron-ores in a finely ground condition are described in the *New Zealand Journal of Agriculture* for June, 1931. After considerable experimenting, extending over some years, the finely pulverized native iron carbonate known as spathic iron-ore has proved to be successful as a preventive lick for all classes of ruminants.

It has been known for some time that bush-sick land such as the coarse-textured soils of Mamaku, when utilized in cattle-farming, gradually become less bush-sick—that is to say, the reverse process takes place to that of the “deterioration” which affects some pasture lands derived from volcanic aerial deposits of very fine texture—for instance, Mairoa soils. This gradual improvement, coincident with much dairy-farming carried on, has been experienced in the home paddocks at the Mamaku Demonstration Farm, which, from the original surface-sown pastures among stumps, has been converted into ploughable land, cropped with turnips, laid down in new pasture, and thereafter top-dressed for several years with basic slag and superphosphate mixture. It has now been demonstrated that this new pasture on which stock require little or no iron treatment to keep healthy has considerably increased in iron content. (See *New Zealand Journal of Agriculture* for December, 1930, p. 419.) The question whether the administration of iron to cattle on such improved farms will show increased milk-yield is yet to be determined.

The result of the work undertaken during the last three years shows that bush sickness, when unaccompanied by other complications, such as ragwort poisoning, need no longer be feared in any scheme for settling new country or in treating old-settled country. The prevention of and cure for bush sickness is definitely proved to be the administration of iron in a suitable form to the animals themselves. Improvements may be effected by giving the daily dosage of iron, but the remedy undoubtedly has been found, and all that remains for the practical farmer to do is to automatically apply it mixed with the necessary salt lick. The cost of the iron is so small that at the outside it will amount to only a few pence a year per cattle beast.

#### DETAILED RESULTS.

*Rotorua Pumice or Near-by Volcanic Lands.*—Attention has been devoted to the carrying-out of—

- (1) Large-scale lick and pellet-feeding experiments with the object of discovering the most economic method of supplying assimilable iron to ruminants, especially sheep; and
- (2) To the growth and collection, for analysis, of representative samples of pasture plants and mixed pasture free from contamination.

Both the feeding of pellets containing meals, citrate of iron, and ammonium, and the administration of a lick composed of common salt and finely ground native carbonate of iron (a local product), have succeeded in the case of sheep which previously it was impossible to keep or rear on bush-sick land. Probably some of the good effect of the pellets is due to the concentrated food, in the form of meals, which they contain. As this is an expensive and unessential ingredient, it is hoped that suitable licks may be found sufficiently palatable to enable it to be dispensed with.

Native carbonate of iron added to ensilage during the building of the stack was found to be an effective and economical method of administering iron to cows and calves, and also widely applicable in the bush-sick areas. Analysis shows that the iron is thus rendered more soluble. A prominent settler on bad bush-sick country (Mamaku) has introduced sheep, and intends breeding them on this type of country. He is confident of keeping all stock healthy with the aid of iron-carbonate treatment, which he has succeeded in automatically giving to the whole flock. He carries 1,000 sheep, and has now 350 ewes in lamb at Mamaku since February. Doubtless, therefore, with little additional expense or trouble, the whole of the lands affected with bush sickness *in any degree* can be farmed without fear. This opinion has been arrived at before with regard to cattle-farming, and now can be asserted with regard to sheep-farming; and this certainty of being able to keep both kinds of stock on the same country will make it much easier to farm than if the worst land had to be restricted to cattle. To name only a few reasons, sheep will keep the ragwort down without ill effects, will assist in effecting a better utilization of pasture, and the diverse quality of the products gives a better chance of making bush-sick country pay than if only one class of stock were carried. In making ensilage it is recommended to dissolve 1 lb. of the ammonium iron citrate in water, mix with molasses, and spray on to the layers of ensilage from time to time as the stack is building, 1 lb. of the citrate to 1 ton of ensilage. The option secured over a deposit of spathic iron-ore at Huntly has been continued, and small quantities of the powdered mineral distributed free, or at cost price, to farmers in bush-sick areas for experimental purposes. Results have been very encouraging, and many requests for a supply of the material have been received. The fine grinding of this hard iron-ore has been generously undertaken practically free of charge by the Challenge Phosphate Co., at Otahuhu, a service much appreciated. Analysis of the herbage produced in pot experiments with limonite (hydrated iron oxide) from Whangarei showed that its incorporation with pumice soil did not increase the amount of iron taken up by the plant. Probably, however, the limonite will find a use as an ingredient in stock-licks for providing iron directly to the animals. Stock-feeding experiments with limonite from Whangarei and from Onekaka, Nelson, are now in progress in the Rotorua district.

Green-manuring experiments for the improvement of the pumice soil have been proceeded with in two localities. Good crops of (a) red clover, (b) lupins, have been ploughed in and the areas resown in pasture.

The drainage-water from the lysimeter has been regularly collected and analysed. Applications of superphosphate to the surface soil have not led to loss of phosphate through the drainage-water.

*Ngaroma Experiments.*—Ngaroma is an isolated district some 32 miles from Te Awamutu, where there are several types of soil. During May, 1930, an inspection was made of experiments which have been in progress for several years at Ngaroma, where there is evidence of more than one deficiency