Magnesium Investigations.

In view of the occurrence of magnesium deficiency symptoms in the Nelson District, field and laboratory work has been initiated to study the effect of various carriers of magnesium on crop yield. This has involved the use of silico-superphosphate, magnesium carbonate, and magnesium sulphate as suppliers of magnesium.

(*a*) *Pastures.*

Two observational trials on pasture, one at Glenhope and the other at Dovedale, using silico-superphosphate in comparison with basic superphosphate, did not suggest that there was any marked difference in the responses from the fertilizers. At Glenhope there was a doubtful increase in clovers, and at Dovedale a slight encouragement of subterranean-clover seedlings, on the silico-superphosphate plots.

At Sherry River a comprehensive series of treatments has been set out embracing silico-superphosphate, magnesium carbonate and basic superphosphate, and magnesium sulphate plus basic superphosphate, basic superphosphate being used as a control. Equivalent amounts of magnesia were used in the mixtures. Sulphate of potash has been used on portions of plots of each of these treatments. The plots are used as a mowing trial and to obtain samples for chemical analysis. No chemical data are yet available, but yield data over most of the season can be summarized. No increase in yield appears to have resulted from the use of magnesium in the fertilizers in the absence of the potash applications. Where sulphate of potash was applied at the rate of 2 cwt. per acre responses were particularly marked on those plots where silico-superphosphate and magnesium sulphate mixture had been used. With the magnesium carbonate mixture the response was much less. In terms of percentage increase over the non-potash plots, the treated areas yield as follows: Basic superphosphate, 111 per cent.; basic co-superphosphate, 125 per cent.; magnesium carbonate and superphosphate, 116 per cent.; silico-superphosphate, 134 per cent.; magnesium sulphate and superphosphate, 135 per cent.

(*b*) *Potatoes.*

Four trials with Sutton's Supreme potatoes were established to compare yields from silico-superphosphate and basic superphosphate when used in conjunction with sulphate of ammonia. Sulphate of potash was also included in the trials on two sandy soils. On the two sandy soils lower yields were obtained with silico-superphosphate mixture than with basic superphosphate mixture; on the coarser soil the decrease was significant. These two trials gave the lowest yield of the four trials. The remaining trials were on heavier soils. One on the Cawthron Institute grounds showed a non-significant increase in yield on the silico-superphosphate plots. On the other trial at Stoke, small but significant increases in yield amounting to about 12 cwt. per acre were obtained for silico-superphosphate and for an equivalent amount of magnesium sulphate. The difference in yield between silico-superphosphate and magnesium sulphate plus basic superphosphate was not significant.

A more complex trial has been arranged at the Sherry River, where silico-superphosphate and magnesium sulphate are used with and without potash. This trial has not yet been dug.

(*c*) *Turnips.*

A small trial at Sherry River with Imperial Green Globe turnips will be used to compare the effect of silico-superphosphate with basic superphosphate and basic superphosphate plus magnesium sulphate. Up to the present the magnesium sulphate plots look the best, having the largest amount of top growth on the plants.

Serpentine and Superphosphate Fertilizers.

In view of the possibility that mixtures of serpentine and superphosphate might be required to be made at locations away from superphosphate-works, laboratory tests have been made to examine the reactions which take place on mixing finely ground serpentine with superphosphate at ordinary temperatures. Four mixtures containing serpentine (32 per cent. MgO and ground for 92 per cent. to pass a 100-mesh sieve) sufficient to revert from one-half to twice the amount of water-soluble phosphate in the superphosphate were made. These were held at ordinary temperatures and sampled periodically. A small rise in temperature occurred after mixing. Some setting also was found to take place, but the lumps were very readily broken up. The amounts of water-soluble phosphate, lime, and sulphate radicle in the mixtures decreased rapidly, whilst water-soluble magnesia increased with time of reaction. After about two weeks' storage only insignificant changes occurred in the proportions of water-soluble constituents. At this stage only 50 per cent. of the original water-soluble phosphate content remained in that state in the two mixtures with the largest proportions of serpentine. The water-soluble magnesia (MgO) was about 2 per cent., which indicated that from one-half to one-quarter of the magnesia in the serpentine had been converted to water-soluble condition.

More recent experiments using similar mixtures to which 5 per cent. and 10 per cent. of water have been added have shown that within three hours from the time of mixing 75 per cent. of the water-soluble phosphate had been rendered insoluble. At the end of seven days the analyses indicated that the interreaction between the ground serpentine and superphosphate was virtually completed.

The results of the experiments suggest the possibility of local fertilizer-vendors and, indeed, farmers preparing a reverted superphosphate with properties similar to silico-superphosphate.