

applied directly to the succeeding pasture resulted in a good vigorous growth of the grasses and clovers, but where a fresh application of manures was withheld the phosphatic residues from the preceding crops seemed to have little or no effect, the growth being slow and feeble.

What had happened to the residuum of 5 cwt. basic superphosphate to nullify its effect less than a year after its application? We know that very little leaching of phosphoric acid occurs at any time, and if there is a sufficiency of humus and clay in the soil no leaching at all occurs. This Ruakura soil, naturally deficient in these constituents, had been rendered more so in the case of humus by the cultivation of the preceding crops. The humus was at a low ebb, and some slight leaching may have occurred, but certainly not nearly to the extent of removing from the surface soil the equivalent of 5 cwt. of basic superphosphate per acre. As a matter of fact, it has been found elsewhere that, after applying $3\frac{1}{2}$ cwt. of superphosphate per acre annually for forty years, nearly the whole of the unused phosphoric acid remained in the surface 9 in. of soil. We can only conclude, therefore, that the greater part of the two applications at Ruakura was converted into less soluble forms of phosphate, which were too slow in action to maintain a vigorous growth of grass; and this is undoubtedly the fate of much of the phosphatic manure which is applied annually to New Zealand soils.

The aim of the farmer should be, while stimulating the early growth of grass and crops by small to moderate applications of readily available phosphates, to make the unused residuum of fertilizer applications contribute to production by the one and only way to make these more active—that is, by the cheaper expedients of keeping up the lime and humus supplies. If this were done there should be less cause for concern about impoverishment of the land through the grazing of live-stock. We know from experience that land that is left as pasture actually gains in the fertility of the surface soil, this gain being due to the coating of organic matter derived from the pasture and from the droppings of stock, from the accumulation of nitrogenous compounds derived from the atmosphere, and from the mineral matter brought up from the depths of the soil. If these elements of fertility are rendered active by an occasional dressing of lime, a progressive state of improvement is bound to follow for many years. Doubtless this improvement is effected to some extent by drafts made upon the phosphate-content of the soil and subsoil; but even this appears insignificant in the light of the fact that a mature sheep sent off the farm takes with it no more than a pound or two of phosphoric acid.