THE MINOR ELEMENTS IN RELATION TO EMERGENCY CROP PRODUCTION PROBLEMS

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The minor element problem is in a large measure the problem of unproductive soils. It embraces many features of the effects of lime, of organic matter, of soil oxidation and the efficiency of the major fertilizer materials. Land use and farming methods, plant adaptations, and even sociological problems are in some degree associated with the minor element factor.

In the course of time, agricultural practices have become stabilized on the basis of soil conditions as they are, or as they may have been altered by past treatment. It may happen, therefore, that a region will appear to have no need for additional supplies of the minor elements because the crops customarily grown have, of necessity, a very low requirement for those elements. In the southeastern states, for example, there is large scale production of cotton and tobacco, crops that respond to very small amounts of the minor elements if any response is noted at all. Corn and other feed crops and livestock are produced successfully only to a limited extent.

It is also matter of record that crude fertilizer materials have, in the past, supplied enough of some of the minor elements to satisfy the need of the major crops of the area. Even with this low requirement and the amounts furnished by the older forms of fertilizer, however, it has generally been necessary to keep soils distinctly acid to maintain crop production on a satisfactory level.

Soils that are deficient in the minor elements often exhibit a marked heterogeneity with respect to crop production. They are not customarily limed, and systematic practices of crop rotation are exceptional.

One of our typical soil problems was found on a dairy farm in a field, one half of which was unproductive. Results of a soil test showed that the unproductive side had been liberally limed. Cows pastured on this field, however, invariably congregated on the limed side even though oats growing there showed unmistakable evidence of a need for manganese.

In solving this problem three alternatives were possible, viz., the soil could be acidified so that oats would grow, the soil could be limed throughout and the deficiency corrected by fertilization with minor elements, or a crop such as rye, having a low manganese requirement, could be grown. The second plan was recommended. Lime was applied liberally to the entire farm and supplemented with basic slag and borax. Crop production has been greatly improved and, since this soil management system has been introduced, the herd has been rated third in the Nation on production for the Holstein breed. An unexpected by-product of this work has been the disappearance of a breeding trouble common on many farms of the region and presumably associated with a deficiency of manganese in the feed. It is of some concern that this defect occurs with the appearance of deficiency symptoms in the crops.

It is impossible at this time to discuss the advantages of a system of farming based on a better status of the soil, but the experience just clearly indicates the possibility of success with a program through the use of minor elements. It is in the very broadest sense was this an experiment since it represented the large scale application of recognized principles to a specific production.

MAGNESIUM

The use of lime is further complicated by the fact that some forms of this material may carry appreciable amounts of minor elements. It is not necessary to point out here the significance of the magnesium content of dolomitic limestone. Practical aspects of the magnesium problem have been very well explained and little remains to be done in that field. It has demonstrated that the magnesium of dolomitic limestone when supplied in a fertilizer becomes available rapidly enough to satisfy all normal requirements of plants.

Once in solution, this element reacts in the colloidal complex in the same manner as a fertilizer. It may, however, be converted into an insoluble compound in the presence of an excess of calcium lime, probably as a complex silicate.

The magnesium problem is greatly simplified by the fact that this element is an essential component of chlorophyll. Since it is not immobilized in the cells of the plant and, as it appears to function efficiently of any other nutrient element, it is possible to refer to magnesium deficiencies without an evolution as to secondary physiological reactions.

Insofar as the current emergency is to be met, the practical phases of the magnesium problem have been considered solved subject only to the limitation placed on the use of lime. No difficulty need be encountered in identifying magnesium deficiency through means of the quick chemical tests. The presence of as much as 40 pounds of exchangeable magnesium per acre in equilibrium with the soil complex before fertilization insures an adequate supply for any requirements.

ZINC

Very little fundamental work has been done with zinc. A deficiency has been noted for corn on the southeastern sandstones and for peanuts elsewhere. This element is classified as a minor element of tobacco, and considerable work has been done with it in connection with tobacco production. Zinc may be applied directly as a fertilizer.

In passing, it may be remarked that we have considered ourselves fortunate in having, within the past year, the services of a chemist particularly interested in the study of minor elements and as such now has increased our knowledge in this field.

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