ON THE NUTRITIONAL PROCESSUS OF PLANT AS AFFECTED BY SOIL POROSITY.

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All the soils are *heterogeneous*, this heterogeneity being moreover increased by the application of various fertilizers which are not evenly distributed in soil. On the other hand, a soil is a porous and *discontinuous* medium, deprived—except in some particular cases—of moving water, i.e. not retained by a more or less strong power. Thus, a conspicuous part of the vacuum is filled by the air. These conditions are very different from the conditions prevailing in plants grown on nutritive solution, as done in experiments on the mineral nutrition of the crops. It is questionable to which degree these physical properties—peculiar to the soil—affect the nutritional processus of the plant.[1]

Several authors[2] suggested the possibility of the absorption of the elements fixed by direct exchange between the colloidal micelles of the soil absorbing complex and the pecto-cellulosic colloids forming the external membrane of the rootlets. The above hypothesis is not necessary if we consider the diffusion phenomena, not only as concerns water-soluble elements, but also for the elements fixed by adsorption, like P_2O_5. Following experiments are significant in this regard:

A water gel of 1% gelose, in which 2 c.c. 5 of a sulpho-molybdic reagent per 100 c.c. (pH $= 5{\cdot}0$) were incorporated, is prepared. Some small soil aggregates (of 1 to 2 mm. diam.) are placed on the surface and set in by a light finger pressure. After 30 min. the reduction reagent is pulverized on the surface. A blue zone appears around the granules, thus demonstrating the diffusion of P_2O_5 and measuring its intensity.

Furthermore, we directed our attention towards the diffusion of P_2O_5 of superphosphate in a discontinuous sandy medium, of various moisture contents.[3] In this purpose, columns of fine sand were used, of 6, 9 and 12% moisture content, this last figure representing the retention capacity over vacuum. The superphosphate was placed either at the lower or at the upper part of the columns, and samples were taken after 15 days. Thus it was observed that diffusion, very slow at low moisture contents, increases with water contact up to retention capacity. In clay soils the ionic diffusion is still much more restrained.

We also investigated the variations in the concentration of the soil solution, when the amount of P_2O_5 applied as superphosphate increases. The results obtained indicate that, in most soils having a high fixing power, in order to raise the concentration up to 1 mg. per litre corresponding to the maximum effect in a liquid solution, a much larger application of fertilizers than that effectively required for the maximum field yield appears to be necessary.

To sum up the above considerations support the following views:

(1) The concentration in a given element of the solutions present in the soil is not uniform, especially after a fertilizer application. This heterogeneity is more marked with granular fertilizers or in the case

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[1] The low ionic migration in the suspensions of clay has been observed by R. Schofield, (*Discussions of the Faraday Soc.*, 1948? No. 3).

[2] Jenny, *Soil Sci.*, 1939, t. XLVII, p. 257.

[3] *C. R. Acad. Sci.*, 1950, t. 230, p. 595–598.

of placement, chiefly when the moisture decreases below the retention capacity of the soil. The laboratory methods, in which a liquid reagent is used, are destroying the structure of the soil in situ. These methods determine the supply of an element in a more or less labile form. Now the plant must be able to utilize in a different way this amount, according to its topographical distribution in the whole mass and the water contents of the medium. Rainfall, as practice shows, has a marked influence both on the utilization of the fertilizing elements, as ascertained through plant analysis, and on the efficiency of mineral manures. Homogeneity in the soil solution can only be assured when the moisture tends towards saturation and when a speedy diffusion of the dissolved materials occurs in strongly leached, weakly buffered soils. These facts explain that the results obtained through analysis don't have but a probability value, and that a discordance can be observed between the laboratory results and the response of crops to fertilizer. This discrepancy is not related to the constitution of the reagent used but to the principle itself of the method. Thus all the efforts made in view of discovering a reagent having an absolute value will remain fruitless.

(2) A narrow and permanent correlation between the estimation of the soil reserves and the plant uptake during the growth period cannot be expected. These two notions must be distinguished. The first one has a static and permanent character, whilst the second one depends on the climatic conditions, especially the moisture of the medium, which in laboratory experiments is accurately maintained at a high and constant level. The requirement in a fertilizing element, as stated by soil analysis, has a practical value according to the probability degree resulting from the comparison of the analytical data with the information obtained through a long field practice. Nothing more may be expected. The plant analysis shows us, indeed, the nutrition in the same soil to vary considerably in course of the years; thus an optimum cannot be precisely determined. As regards the discordances sometimes observed between the two groups of methods, they always disappear in the extreme cases.

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