SOME SOIL FACTORS IN NITROGEN FIXATION BY LEGUMES

Abstract

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Nitrogen fixation by legumes is closely related to the amount of exchangeable calcium which the crop can take from the soil. The amount so taken is not necessarily related to the total supply; it may be only a small and variable portion of this supply.

The efficiency with which the exchangeable calcium is taken is related to the degree of calcium saturation. The efficiency increases decidedly as the degree of saturation increases. No nitrogen fixation occurs in Beidellite clay, unless the calcium saturation exceeds 50 per cent and the clay carries only adsorbed inorganic ions.

When the larger organic cations are adsorbed on colloidal clay, the accompanying inorganic cations are more effectively used by the plants. This suggests a possible explanation for effective nitrogen fixation by legumes on soils of higher organic matter content, even under significant degrees of acidity.

Calcium plays a possible role in the assimilation into the growing plant of the seed phosphorus, which may even be lost to the soil by soy beans, for example, at low calcium levels. No nitrogen fixation is possible when such loss occurs.

Exchangeable magnesium is of significance in nitrogen fixation possibly indirectly through its influence in increasing the effectiveness of calcium.

Exchangeable potassium of the soil plays a significant role in nitrogen fixation, but as larger amounts are taken in relation to the amount of calcium, the nitrogen fixation in relation to plant growth by legumes is reduced. The potassium may replace the calcium, thus resulting in a widening of the potassium-calcium ratio to the point where possibly the legume does not exercise its nitrogen-fixing ability.

The role of such a potassium-calcium ratio may possibly be helpful in understanding the organic matter levels in different soils in relation to their degree of calcium depletion, or to their stage in soil development.—Author abstract.


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