(Since these experiments, similar effects have been obtained with young plants of oats and rye; barley did not respond.)

In a brief review of the elements considered essential in plant nutrition, Hewitt[1] tentatively described aluminium as a potential micronutrient. He referred to the number of reports between 1920 and 1945 of beneficial effects of aluminium on plant growth but noted that the reliability of the conclusions had afterwards been questioned by Hutchinson[2] in a detailed review of aluminium and plant growth. Since these reviews, work with aluminium has been concentrated on those levels causing toxicity, and it seems possible that some important effects of lower concentrations have been overlooked, effects which could be of physiological and ecological importance.

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SOIL DEVELOPMENT AND THE AVAILABILITY OF PHOSPHORUS AND POTASSIUM TO *ASPERGILLUS NIGER*

By Dr. B. N. ROY

School of Agriculture, Kwame Nkrumah University of Science and Technology, Ghana

THE extent to which the active or kinetic release of minerals to micro-organisms from the various stages of weathering of the soil parent material is not well understood. It appears that there is practically no published literature in this respect. In the investigation reported here the release of phosphorus and potassium from fresh rock, weathered rock, detritus, lithosol and soil of a basic metamorphic rock (hornblende schist) was studied using the *Aspergillus niger* method[1,2]. This method provides a sensitive measure of the amount of phosphorus and potassium available to the organism and should throw a light on the release of these two minerals as the decomposition of the rock advances.

The samples representing the sequence of weathering from fresh rock to the soil were collected from the same site, at Creag Liath, Ballater, Scotland, ensuring that all had been subjected to the same soil-forming factors. The size fraction (< 2·0 mm.) of fresh rock, weathered rock and detritus was prepared by hand grinding in a mortar until all particles passed through a 2-mm. sieve. This fraction contains a complete size-range of mineral matter similar to soil, namely, coarse sand, fine sand, silt and clay. Lithosol and soil were passed through a 2-mm. sieve.

Table 1. Total Phosphorus and Potassium Content of Rock in Different Stages of Weathering with the Calculated Proportional Loss of Constituents

Constituents	I Fresh rock (per cent)	II Weathered rock (per cent)	III Detritus (per cent)	IV Percentage of each constituent lost * Weathered rock	Detritus
P_2O_5	0·50	0·20	0·10	83·80	93·00
K_2O	2·30	1·60	1·20	64·30	82·70

* Fe_2O_3 used as a constant factor for calculation. Calculations for the proportional loss of constituents were carried out according to Merrill[3].

Table 2. Pad Weights and the Phosphorus and Potassium Content of the Mycelium of *A. niger* grown on Rock in Different Stages of Weathering and on Soil

Sample	Total weights of mycelium from 4 cultures (mgm.)		Amount of P_2O_5 and K_2O in 4 pads by analysis * (mgm.)		P_2O_5 and K_2O absorbed by *A. niger* from 100 gm. of sample (mgm.)	
	P_2O_5	K_2O	P_2O_5	K_2O	P_2O_5	K_2O
Fresh rock	1,231	814	1·16	0·924	5·80	9·24
Weathered rock	1,067	1,140	1·04	1·202	5·20	12·02
Detritus	1,344	1,148	1·24	1·562	6·20	15·62
Lithosol	1,958	1,841	2·06	2·035	10·30	20·35
Soil	2,278	2,466	2·29	2·634	11·45	26·34

* Total phosphorus and potassium in the mycelial pads were determined according to Mehlich *et al.*[4].

Phosphorus and potassium both exhibit a correlation between the amounts of these minerals released and the stage of weathering. It will be seen that in spite of a great loss of phosphorus and potassium in the course of weathering, as revealed by rock analysis (Table 1), the release of these two minerals to *A. niger* is found to increase with the advancement of decomposition. The pad weight in relation to phosphorus (Table 2) diminishes slightly from fresh rock to weathered rock; but again the weight increases significantly on passing from detritus on to the soil. The significant release of phosphorus from detritus to soil is of interest in view of the findings of Polynov[4] and Nikiforoff[5], who have concluded that apart from physical and chemical weathering which render minerals available, the effect of pioneer organisms—especially lichens and mosses—in organic weathering cannot be overlooked. The presence of these organisms in detritus, lithosol and soil is frequent. The increase in pad weight, in relation to potassium (Table 2), is significant throughout. The total phosphorus and potassium in the mycelial pads (Table 2) grown on samples in general, parallels the weights of all the pads. The release of these two minerals increases in a manner corresponding with the increase of pad weights. These determinations, however, tend to emphasize that the amounts of phosphorus released to micro-organisms increases sharply in the later stages of weathering, but for potassium there is a definite gradual trend to release more as the decomposition of the rock advances.

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