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Rock phosphate standard characterisation

Truong Binh

28 phosphates utilized in this network were collected from 15 countries, representing a large variability of origin, treatment, and transformations. Mineralogical composition (mineralogy, crystallography), physical (granulometric distribution, specific surface and porous volume) and chemical (total element composition, P solubility in conventional reagents) analyses were carried out in well established laboratories using standard methodologies. This standard characterisation was made within the frame of a Co-operation Agreement between the Joint FAO/IAEA Programme and the World Phosphate Institute (IMPHOS).
The results confirmed the variability of the samples but also allowed to group them according to different criteria such as minerals content, total element composition, P solubility and reactivity. Further studies should be pursued for their validation through correlation with the agronomic data obtained in controlled and field conditions.

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Comparative Evaluation of the Effect of Rock Phosphate and Mono-ammonium Phosphate on Plant P-nutrition in Sod-podzolic and Peat Soils

Iossif Bogdevitch

The direct application of finely powdered rock phosphate (RP) imported from Russia has been suggested as an alternative to the almost twice more expensive water-soluble mono-ammonium phosphate (MAP) on acid soils. The direct application of RP potentially might be effective on acid (moderately limed) sod-podzolic and peat soils, which occupy about 30% of agricultural land of Belarus.

Two pot experiments were conducted in 1997 and1998 (1) to make a comparative evaluation of availability of phosphorus from RP and MAP for growing crops and (2) to study effect of P fertilisers on the reduction of the root uptake of radionuclide ^{137}Cs in the contaminated soils. Lupin was grown on sod-podzolic silty clay loam soil with pH $_{H2O}$ 6.2 and medium level of available P and ryegrass on peat soil with pH 4.9 and low level of the native soil P fertility, using the ^{32}P isotope dilution technique.

Application of RP and MAP at rate 40 mg P/kg soil contributed similarly to the P nutrition of lupin plants. The Pdff values, i.e., the fractions of P in the plants derived from the applied RP and MAP were 7.4 and 8.4%, respectively and P fertiliser recovery values - about 1% for both fertilisers. The application of RP and MAP on peat soil had different effects on P nutrition for rye grass plants. The Pdff values were 14.9% for RP and 22.1% for MAP. It may be concluded that for most of the crops on sod-podzolic soils it is preferable to apply water-soluble P forms as MAP. However, for the plants with a high root ability to utilise P, such lupin, on acid sod-podzolic silty clay soils (pH $H_20<6.0$) RP may be used for direct application as well as water-soluble P fertilizers. In common, for peat soils application of water-soluble P fertilisers is also preferable. Taking into consideration the difference in costs of the fertilisers, RP application to acid peat soil (pH $H_20<5.0$) may be reasonable for substantial improvement of grassland in the radionuclide contaminated area.

XA9953354

The results of second pot experiment suggest that direct application of RP may be more effective than the use of water-soluble P fertilisers in reducing the plant uptake of ^{137}Cs on the acid sod-podzolic and peat soils. A significant reduction of the root uptake of ^{137}Cs by lupin on RP-treatment (-16%) and MAP (-8%) was found in comparison with that of the control treatment. The activity of rye grass plants on peat soil decreased by 27% after application of RP, but only 7% after MAP application. These data are very important, because the tested soils are widely spread in the area by the Chernobyl accident. It is necessary to continue the comparative evaluation of RP and MAP effectiveness in field trials for developing economically sound practical recommendations. Direct application of RP may be one of the effective countermeasures for decrease of ^{137}Cs transfer from the contaminated acid soils to the crop production.

Soil conditions promoting and restraining agrochemical effectiveness of water-insoluble phosphate sources, in particular, phosphate rock

Zenoviu Borlan

Aspects of phosphate rock (PR) use instead of water soluble phosphorus sources were investigated. The studies were conducted using both ^{32}P radioisotope dilution technique and the (non-isotope) difference method. Maize for green fodder (*Zea mays* L) and ryegrass (*Lolium multiflorum* Lam.) were grown in Mitscherlich type pots of 7 Kg dry soil and in small pots of 1.25 Kg dry soil capacity, respectively, on several base-unsaturated Hapludoll and Hapludalf soils. Soil aptitude to be dressed with phosphate rocks (PR) was judged based on experimental data considering soil adsorbed acidity (Ah), humus content (H^2), cation exchange capacity (T), sum of exchangeable bases (SEB) and mobile (easily soluble) phosphate content (P_{AL}) in the soil, combined in a rock phosphate use opportunity index of the soil (PRUOIS):

$$PRUOIS = \frac{A_h * H^2 * T * 100}{SEB * 10^{0.0245 * P_{AL}}}$$

Rock phosphate suitability for direct use was evaluated by means of rate of PR-P dissolution (PRPRS) in a 0.6% ammonium heptamolybdate in 0.01M calcium chloride solution (ppm P) and its carbonate content (%$CaCO_3$) in PR, both combined in a phosphate rock suitability index for direct use (PRSIDU):

$$PRSIDU\,[ppm\,P/\min] = PRPRS * (1 - 0.03 * CaCO_3)$$

Water-insoluble PR sources studied were: fluor apatite from Kola-Russia; Morocco; Kneifiss-Siria; El Hassa-Jordan; Gafsa-Tunisia; North-Carolina - USA and Arad-Israel, PR all compared with TSP applied at the same rate of P.

Neither PRUOIS nor PRSIDU taken apart could explain satisfactorily the variance of PR efficiency as P source as determined both by ^{32}P isotope dilution and difference method, while synthetic index obtained by multiplicative combination of these: PRUOIS x PRSIDU did correlate highly significantly with indices of agronomical efficiency of PR, assuring their determination of at least 80%.