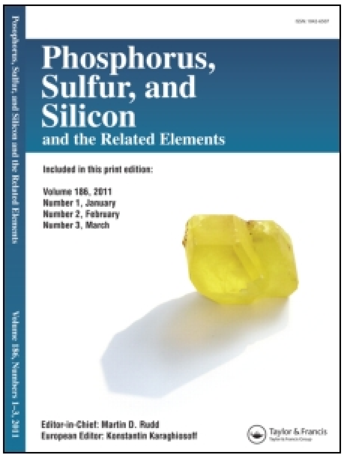

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Use of Rock Phosphates for Direct Application to Cultivated Soils in Canada: Past, Present and Future Research Orientations

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USE OF ROCK PHOSPHATES FOR DIRECT APPLICATION TO CULTIVATED SOILS IN CANADA: PAST, PRESENT AND FUTURE RESEARCH ORIENTATIONS

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INTRODUCTION

Besides the general optimal soil conditions (low phosphorus and calcium contents, low pHs) the main factor responsible for the use of rock phosphates for direct application to cultivated soils in Canada was the appearance on the fertilizers' market of Hyperphosphate Reno a finely ground rock phosphate from Tunisia, a product sold worldwide by a company (Compagnie Nord-Africaine de l'Hyperphosphate Reno) with headquarters in Paris. It is interesting to note the late appearance of rock phosphates for direct application to agricultural soils in Canada compared to the US where they had been in usage since the late nineteen century and beginning of the twentieth (the Morrow Plots of Illinois go back to 1876!). Sales of that product, mainly to Quebec, and some to New Brunswick province, peaked at about 6000 tons per year in the mid fifties. It is interesting to note that by 1962 Hyperphosphate Reno was not available anymore. The availability of less expensive, more soluble, more concentrated and easier to apply forms of phosphates such as triple superphosphate, mono- and di-ammonium phosphates (MAP and DAP) completely displaced the rock phosphates business in Canada as well as in the USA. Anyway for few years the use of rock phosphates for direct application raised questions in the research and extension communities regarding their efficiency as compared to the standard form of phosphatic material then used, that is the normal superphosphate.

The objectives of this presentation are to review research done in Canada with Hyperphosphate Reno, to present what is being done now with rock phosphates in general, and to examine the future research orientations.

RESEARCH DONE IN THE PAST

The Canadian Department of Agriculture[1] is the institution which did most of the research at its different research stations. The general objective was to evaluate Hyperphosphate Reno compared to superphosphate and some other forms of natural phosphates. Eight different types of crops were studied for their response in the field and the greenhouse. They included pastures, cereals, hays, alfalfa, white clover, rutabagas, turnips and potatoes. The results show that: with pastures Hyperphosphate Reno could give the same yields as those obtained with superphosphate; with oats, on the same total P content superphosphate was more efficient than Hyperphosphate; with hays per unit of weight superphosphate was more efficient than the Hyperphosphate in an approximate rates of 1.8 to 1; for alfalfa the results are mixed, one experiment doesn't show any difference, pound for pound, in the yield and the other shows a difference of 18,2%; for white clover, it was found that manure applied with fertilizers could benefit yields by a factor of 2.5 for Hyperphosphate and 4.5 for superphosphate, superphosphate was more effective than Hyperphosphate; for rutabagas no difference was observed between superphosphate and Hyperphosphate; for turnips superphosphate was more efficient than Hyperphosphate; and for potatoes superphosphate was more efficient.
Finn et al.[2] conclusively showed with their data the superiority of superphosphate over two rock phosphates in increasing yields of oat grain. However rock phosphates performed better than did superphosphate resulting in higher yields of alfalfa hay. Ouellette[3] had also

mentionned that rock phosphates seemed to work best with calcium hungry plants such as alfalfa and clover. Cescas[4] comparing various rock phosphates among themselves and with different levels of superphosphate has observed the same tendencies for alfalfa. In three cases out of four Hyperphosphate Reno was more efficient than superphosphate. In general one unit weight of superphosphate was as efficient as six units of rock phosphates. It is not surprising then that the relatively poor efficiency combined to a too high pricing policy simply eliminated the use of rock phosphates for direct application to soils.

PRESENT WORK

Chabot et al.[5] are presently working on the microbiological solubilization of different forms of phosphorus present or applied to soils. Preliminary results are shown at the poster session.

FUTURE WORK

Two procedures to render rock phosphates more soluble exist: 1) complete or, nowadays, partial acidulation with sulfur, sulfuric acid or phosphoric acid, and mixing with regular superphosphate, or the addition of an acid resin. Work at IFDC seems to favor the partial acidulation procedure especially with sulfuric acid, crops often showing a simultaneous response to sulfur and phosphorus; 2) biosolubilization with added bacteria, fungi, actinomycetes, isolated from the soils from the rhizosphere of crops of interest, screened for their efficiency, and applied as such or genetically manipulated through the use of biological approaches as already done by Goldstein and Liu[6]. Biosolubilization will also look into the products of reaction of rock phosphate with soils such as aluminic-, ferric-, reductant-, and calcium-P forms also produced by natural weathering of original or of added other P forms (i.e. more or less soluble fertilizers). A broad spectrum of organisms will have to be tested, and their possible plant pathogenicity evaluated[7]. Biosolubilization will probably remain a complementary technique to the standard soluble and the partially acidulated fertilizers forms, nonetheless contributing its share to the objective of "food for all".

Beyond the problems of ethics, well regulated by three different departments of the Canadian Governement (Agriculture, Health and Welfare, and Environment) research and development might become slowed down or hindered by the high costs of registration of efficient organisms.

In any case future research will be more biotechnologically oriented.

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