

## CONTENTS

SUMMARY .....	1
PART I. STANDARD CHARACTERIZATION STUDIES	
Standard characterization of phosphate rock samples from the FAO/IAEA phosphate project .....	9
<i>Truong Binh, F. Zapata</i>	
Standard characterization of soils employed in the FAO/IAEA phosphate project .....	24
<i>D. Montange, F. Zapata</i>	
PART II. STUDIES FROM WESTERN EUROPE AND NORTH AMERICA	
The use of <sup>32</sup> P dilution techniques to evaluate the effect of mycorrhizal inoculation on plant uptake of P from products of fermentation mixtures including agrowastes, <i>Aspergillus niger</i> and rock phosphate.....	47
<i>N. Vassilev, M. Vassileva, R. Azcón, J.-M. Barea</i>	
Evaluation of available phosphorus and cadmium associated with phosphate rock for direct application.....	54
<i>S.H. Chien</i>	
Effectiveness of North Carolina phosphate rock and fertilizer tablets in reclaiming disturbed land in Copper basin, Tennessee, United States of America.....	73
<i>F.J. Sikora, J.M. Soileau, J.J. Maddox, J.J. Kelsoe</i>	
Agronomic evaluation of guano sources by means of isotope techniques .....	83
<i>F. Zapata, J.L. Arrillaga</i>	
PART III. STUDIES FROM CENTRAL AND SOUTH AMERICA	
The use of nuclear and related techniques for evaluating the agronomic effectiveness of phosphate fertilizers, in particular rock phosphate, in Venezuela: I. Phosphorus uptake, utilization and agronomic effectiveness.....	93
<i>E. Casanova, A.M. Salas, M. Toro</i>	
The use of nuclear and related techniques for evaluating the agronomic effectiveness of phosphate fertilizers, in particular rock phosphate, in Venezuela: II. Monitoring mycorrhizas and phosphate solubilizing microorganisms.....	101
<i>E. Casanova, A.M. Salas, M. Toro</i>	
Enhancement of the agronomic effectiveness of phosphate rock in a Ferralsol from Cuba .....	107
<i>R. Rodriguez, J.A. Herrera, A. Garcia, A. Nuviola</i>	
Evaluation of methods for quantifying bioavailable phosphorus in a Ferralsol from Cuba.....	117
<i>J.A. Herrera, R. Rodriguez, J.L. Herrera, J.C. Fardeau</i>	
Availability of P from phosphate rock, thermophosphate and triple superphosphate after different incubation periods.....	126
<i>T. Muraoka, A.E. Boaretto, W.B. Scivittaro, E.C. Brasil</i>	
Availability of native and fertilizer P in Brazilian soils .....	131
<i>W.B. Scivittaro, T. Muraoka, A.E. Boaretto, E.C. Brasil</i>	
Plant-availability and fate of P from applied phosphatic fertilizers in two Latosols.....	136
<i>T. Muraoka, A.E. Boaretto, W.B. Scivittaro, E.C. Brasil</i>	
Phosphate fertilizers with varying water-solubilities applied to Amazonian soils:	
I. Agronomic efficiency of P sources .....	143
<i>E.C. Brasil, T. Muraoka, A.E. Boaretto, W.B. Scivittaro</i>	
Phosphate fertilizers with varying water-solubility applied to Amazonian soils:	
II. Soil P extraction methods.....	150
<i>T. Muraoka, E.C. Brasil, W.B. Scivittaro</i>	

Comparative study of P uptake and utilization from P fertilizers by Chilean wheat genotypes in volcanic ash soils .....	156
<i>I. Pino, A.M. Parada, F. Zapata, M. Navia, W. Luzio</i>	
Phosphorus dynamics of representative volcanic ash soils through the use of conventional and isotopic techniques .....	164
<i>I. Pino, A.M. Parada, W. Luzio</i>	
Studies on P availability of volcanic ash soils from Chile amended with various P fertilizers.....	174
<i>I. Pino, A.M. Parada, W. Luzio</i>	

#### PART IV. STUDIES FROM AFRICA, ASIA AND AUSTRALIA

Evaluation of phosphorus uptake from Minjingu phosphate rock, growth and nodulation of agroforestry tree species on an acid soil from Kenya .....	183
<i>N.K. Karanja, K.A. Mwendwa</i>	
Response of seedlings of <i>Grevillea robusta</i> A. Cunn. to phosphorus fertilization in acid soils from Kenya.....	201
<i>N.K. Karanja, K.A. Mwendwa, F. Zapata</i>	
Exploring plant factors for increasing phosphorus utilization from rock phosphates and native soil phosphates in acidic soils.....	211
<i>Guang-Lin Feng, Li-Ming Xiong</i>	
Application of isotope techniques for the assessment of soil phosphorus status and evaluation of rock phosphates as phosphorus sources for plants in subtropical China .....	224
<i>L.M. Xiong, Z.G. Zhou, G.L. Feng, R.K. Lu, J.C. Fardeau</i>	
The use of <sup>32</sup> P radioisotope techniques for evaluating the relative agronomic effectiveness of phosphate rock materials in a soybean-maize crop rotation in acid soils of Thailand .....	237
<i>J. Mahisarakul, P. Pakkong</i>	
Phosphate fixation capacity of Thai acid soils using <sup>32</sup> P isotope techniques .....	250
<i>J. Mahisarakul, P. Sritep</i>	
Use of radioactive <sup>32</sup> P technique to study phosphate rock dissolution in acid soils.....	256
<i>J. Mahisarakul, G.L. Mullins, S.H. Chien</i>	
Field assessment of the relative agronomic effectiveness of phosphate rock materials in a soybean-maize crop rotation using <sup>32</sup> P isotope techniques.....	265
<i>J. Mahisarakul, C. Siripaibool, J. Claimon, P. Pakkong</i>	
Direct use of phosphate rock to improve crop production in Indonesia.....	275
<i>E.L. Sisworo, H. Rasjid, W.H. Sisworo, Haryanto, K. Idris</i>	
Phosphorus availability in an acid tropical soil amended with phosphate rocks.....	294
<i>A.R. Zaharah, H.A.H. Sharifuddin</i>	
The Australian national reactive phosphate rock project — Aims, experimental approach and site characteristics.....	304
<i>M.J. McLaughlin</i>	
Assessment of soil phosphorus tests for situations in Australia where reactive phosphate rock and water-soluble fertilizers are used .....	318
<i>M.J. McLaughlin</i>	
Measuring P availability in soils fertilized with water-soluble P fertilizers using <sup>32</sup> P methodologies .....	331
<i>M.J. McLaughlin</i>	
Effect of fertilizer type on cadmium and fluorine concentrations in clover herbage .....	342
<i>M.J. McLaughlin</i>	
Long term changes in cadmium bio-availability in soil .....	354
<i>M.J. McLaughlin</i>	

#### PART V. STUDIES FROM EASTERN EUROPE AND THE RUSSIAN FEDERATION

The effect of rock phosphates on the content of mineral phosphate forms in Sod-podzolic soils .....	365
<i>V.K. Kuznetsov, N.I. Sanzharova, R.M. Alexakhin</i>	

Evaluation of the agronomic effectiveness of rock phosphates from the Polpino deposit in the Russian Federation and their potential to reduce <sup>137</sup> Cs accumulation in plants .....	371
<i>V.K. Kuznetsov, N.I. Sanzharova, R.M. Alexakhin</i>	
Comparative evaluation of the effect of rock phosphate and monoammonium phosphate on plant P: Nutrition in Sod-podzolic and peat soils.....	378
<i>I. Bogdevitch, S. Tarasiuk, Yu. Putyatin, T. Seraya</i>	
Conditions promoting and restraining agronomic effectiveness of water-insoluble phosphate sources, in particular phosphate rock (PR): I. Indices of phosphate rock use opportunity (PRUOIS) and phosphate rock suitability for direct use (PRSIDU) .....	387
<i>Z. Borlan, I. Gavriluță, M. Soare, D. Ștefănescu, A. Alexandrescu</i>	
Conditions promoting and restraining agronomic effectiveness of water-insoluble phosphate sources, in particular phosphate rock (PR): II. Confirmation and validation of PRUOIS and PRSIDU using <sup>32</sup> P dilution methodology as recommended by IAEA .....	399
<i>Z. Borlan, D. Ștefănescu, I. Gavriluță, M. Soare, A. Alexandrescu</i>	
Conditions promoting and restraining agronomic effectiveness of water-insoluble phosphate sources, in particular phosphate rock (PR): III. <sup>32</sup> P-aided soil-PR interaction studies aimed at enhancing P bioavailability from PR.....	410
<i>Z. Borlan, M. Soare, I. Gavriluță, A. Alexandrescu, D. Ștefănescu</i>	
Conditions promoting and restraining agronomic effectiveness of water-insoluble phosphate sources, in particular phosphate rock (PR): IV. Characterization of mobile P status of soils treated with PR using conventional methods .....	416
<i>Z. Borlan, D. Ștefănescu, I. Gavriluță, M. Soare, A. Alexandrescu</i>	
Comparison of several non-biological methods for evaluating soil and fertilizer phosphorus availability from rock phosphate.....	427
<i>N. Fotyma, S. Gosek, B. Boreczek</i>	
Evaluation of soil and fertilizer-derived phosphorus availability, particularly from rock phosphate, by biological and chemical methods.....	434
<i>N. Fotyma, S. Gosek, B. Boreczek</i>	
Liming effect on P availability from Maardu phosphate rock.....	440
<i>G. Sidlauskas, S. Masauskas, V. Ezerinskas</i>	
Long-term field evaluation of phosphate rock and superphosphate in acid soils of Hungary: Incubation and pot experiments .....	450
<i>T. Nemeth, E. Osztoics, P. Csatho, L. Radimsky, G.Y. Baczo</i>	
List of Participants.....	469
Recent IAEA Publications on Soil and Water Management and Crop Nutrition.....	473