



UNIVERSITI PUTRA MALAYSIA

**AMELIORATION OF VOLCANIC SOILS FROM CAMIGUIN ISLAND
(SOUTHERN PHILIPPINES) USING NATURAL AMENDMENTS**

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By

RENATO D. BONIAO

**Thesis Submitted in the Fulfilment of the Requirements for
the Degree of Doctor of Philosophy in the Faculty of Agriculture
Universiti Putra Malaysia**

June 2000



DEDICATION

This work is dedicated to my wife

Linda

And to

Our three wonderful children Emman, Dandan, and Davi



Abstract of thesis presented to the Senate of Universiti Putra Malaysia in
fulfilment of the requirements for the degree of Doctor of Philosophy

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Chairman : Prof. Dr. J. Shamshuddin
Faculty : Agriculture, Universiti Putra Malaysia
Co-chairman : Prof. Dr. E Van Ranst
Faculty : Sciences, Ghent University

Cultivated and uncultivated soils along the footslopes of Mt. Hibok-Hibok volcano, down to the nearby coastal areas were examined to assess the effects of cultivation on their chemical fertility characteristics. Some selected soils were incubated for 9 months with natural amendments (calcium silicate, ground basaltic pyroclastics, and peat) to determine whether addition of these materials can improve soil surface charge properties, particularly point of zero charge (pH_0) and cation exchange capacity (CEC). Effects of adding the amendment materials on plant growth were investigated with maize as test crop in a glasshouse experiment.



The results showed that cultivated soils have lower % organic carbon (O.C) content and subsequently lower CEC compared to the uncultivated ones. Cultivation also raised pH_0 . Adding peat reduced pH_0 , increased the CEC, and improved their ion retention. Adding basaltic pyroclastics showed promise to improve the charge properties of the soils but as an amendment material, a longer incubation time was needed to detect some influence on the soil. Calcium silicate, on the other hand, gave an extremely high pH_0 and pH. The high values were presumably because the rate applied was too high, which resulted in silicic acid precipitation. Plant response to the amendments (peat and basalt pyroclastics) showed that nutrient uptake was positively related to an improved ion retention of the soils. It also showed that relative heights and weights were linearly correlated with cations concentration in the soil solution.



Abstrak tesis yang dikemukakan Senat Universiti Putra Malaysia
sebagai memenuhi keperluan untuk ijazah Doktor Falsafah

**AMELIORASI TANAH VOLKANIK DARIPADA PULAU CAMIGUIN (FILIPINA
SELATAN) DENGAN MENGGUNAKAN PEMBAIK ASLI**

Oleh

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Tanah vulkanik daripada kawasan hutan dan pertanian di sepanjang kaki Mt. Hibok-Hibok ke kawasan pantai telah dikaji untuk menilai kesan penanaman ke atas ciri kesuburan kimia tanah tersebut. Berberapa tanah terpilih telah diram selama 9 bulan dengan pembaik asli (kalsium silikat, piroklastiks berbasalt dan tanah gambut) untuk menentukan samada aplikasi bahan tersebut membaiki sifat cas permukaan, terutama titik cas sifar (pH_0) dan keupayaan pertukaran kation (KPK) tanah. Kajian rumah kaca juga dilakukan untuk menilai kesan bahan tersebut ke atas tumbesaran jagung.

Keputusan menunjukkan tanah pertanian mempunyai lebih rendah peratusan karbon organik (K.O.) dan KPK berbanding dengan tanah hutan. Kegiatan pertanian menyebabkan kenaikan pH_0 . Tanah gambut telah menurunkan pH_0 , menaikkan KPK dan memperbaiki pegangan ion. Piroklastiks berbasalt menunjukkan kecenderungan memperbaiki sifat cas tanah, walau bagaimanapun ia memerlukan masa yang lebih lama untuk dikesan manfaatnya. Sebaliknya, kalsium silikat menaikkan pH_0 dan pH terlampau tinggi. Nilai yang tidak munasabah ini berkemungkinan disebabkan oleh kadar kalsium silikat yang digunakan terlalu tinggi sehingga mengakibatkan presipitasi asid silisik. Tindak balas tanaman terhadap pembaik tanah (tanah gambut dan piroklastiks berbasalt) menunjukkan pengambilan nutrien oleh tanaman berkait secara positif dengan penambahan pegangan ion tanah. Data menunjukkan ketinggian dan berat relatif tanaman berkorelasi linear dengan beberapa kation di dalam larutan tanah.



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