SOILS 2005 CONFERENCE

PROCEEDINGS

ADVANCES IN SOIL SCIENCE FOR SUSTAINABLE FOOD PRODUCTION

Editors:
Christopher Teh B.S.
Zin Z. Zakaria
Izham Ahmad
Che Fauziah Ishak
Osmanu Haruna Ahmed
Wan Noordin Wan Daud

JOINTLY ORGANIZED

MSSS

UiTM

PROCEEDINGS OF THE SOIL SCIENCE CONFERENCE OF MALAYSIA 2005

"Advances in soil science for sustainable food production"

Park Avenue Hotel, Sg. Petani, Kedah
12-13 April 2005

Editors

C.B.S. Teh
O.H. Ahmed
C.I. Fauziah
A. Izham
Wan Noordin Wan Daud
Zin Z. Zakaria

Organised by

Malaysian Society of Soil Science
Universiti Teknologi MARA

Papers published in this Proceedings have not been refereed. The responsibility of the content rests with the authors.

ISBN 967-9945-27-8

Published by:
Malaysian Society of Soil Science
Locked Bag 254
43409 UPM Serdang
Selangor
www.e-msss.com

S05/09

THE EFFECTS OF APPLYING DOLOMITIC LIMESTONE AND ORGANIC FERTILIZER ON AN ACID SULFATE SOIL CULTIVATED TO RICE

J. Shamshuddin, Totok Siswanto, S.R. Syed Omar, Peli Mat and C.B.S. Teh
Department of Land Management, Faculty of Agriculture, Universiti Putra Malaysia, 43400 Serdang, Selangor Malaysia

INTRODUCTION

The Kemasin-Semerak IADP, comprising a total area of 68,350 ha, was launched 1982. The area is located in the Kelantan Plain; Kelantan is an east coast state of Peninsular Malaysia. The plain is characterized by the presence of a mixture of riverine and marine alluvial soils. Peaty materials sometimes overlain by mixed clayey-sandy sediments occasionally containing pyrite are scattered all over the plain, especially along the coastline. This eventually gives rise to development of acid sulfate soil conditions, which affect crop growth.

Normally, acid sulfate soils are not suitable for crop production. Unless they are properly ameliorated using current technology in agronomic practices, the soils are not used for agriculture production. Among the agronomic problems common to acid sulfate soils are toxicity due to the presence of Al and Fe(III), decrease of P availability, nutrient deficiency and Fe(II) toxicity.

The objective of this study was to ameliorate an acid sulfate soil at the Jelawat Rusa Scheme, Kemasin-Semerak IADP, Kelantan using dolomitic limestone (GML) and an organic-based fertilizer for rice cultivation.

MATERIALS AND METHODS

The location of the trial was the Jelawat Rusa Scheme of the Kemasin-Semerak IADP, Kelantan, Malaysia (06^{o} 00N, 102^{o} 23E). The soils in the experimental plots belong to the Nipis-Bakri Associations (organic soils underlain by sulfidic materials with 50 cm depth), which can be classified as Typic Sulfosaprists. The peaty materials have been somewhat degraded as a result of a long history of rice cultivation. In the soil profile, the sulfuric layer occurs below the depth of 45 cm.

The rice (*Oryza sativa*) variety used in the trial was MR 219. This is the most common rice variety planted by Malaysian rice growers. There were altogether seven treatments, with five replications. The treatment included a control (T1, no lime), 2 t GML/ha (T2), 4 t GML/ha (T3), 6 t GML/ha (T4), 8 t GML/ha (T5), 4 t GML/ha + organic fertilizer (T6) and 4 t GML/ha + fused magnesium phosphate (T7). A demonstration was set up next to the experimental plot, having an area of half a hectare.

RESULTS AND DISCUSSION

The result showed that the initial topsoil pH was low; the values were even lower below the depth of 50 cm. At the depth of 45-60 cm, the pH values were lower than 3.5. This low pH and the presence of jarositic mottles in the soils at that depth qualify the soil to be classified as an acid sulfate soil. The low pH was made even worse by the presence of high exchangeable Al, especially at depth below 45 cm, the sulfuric layers. Peculiar to soil in the Kelantan Plain, the exchangeable Ca and Mg were very low.

The initial topsoil exchangeable Ca ranged from 1.17 to 1.68 $cmol_c/kg$ soil, lower than the required level for rice of 2 $cmol_c/kg$ soil. The initial exchangeable Mg was only 0.50-0.53, but Mg requirement is 1 $cmol_c/kg$ soil. Al concentration of 1-2 mg/kg in the soil solution would cause toxicity to the growing rice plants. Potassium contents seemed to be moderately high and thus would be sufficient for rice growth.

The highest rice yield for the 2nd season was 7.5 t/ha obtained by T6. For this treatment, we had applied 4 t GML/ha in combination with the organic fertilizer. This yield is comparable to the yield of rice grown on good soils in the granary areas of the west coast of the Peninsular Malaysia. Note that the national average for Malaysia is 3.8 t/ha.

It was observed that the yield obtained by T6 was not significantly different from that of T3, T4 and T5. This trial showed conclusively that applying 2 t GML/ha (T2) is not enough to ameliorate the soil for rice cultivation. For the T2, the pH was still low (3.99) and Al was very high (10.22 $cmol_c/kg$ soil). For T7, where 4 t GML/ha were applied in combination with fused magnesium phosphate, the yield was not significantly different from that of T6. It means instead of using organic fertilizer, farmers in that area can apply lime together with fused magnesium phosphate. The Malaysian government gives farmers in the Kelantan Plain this form of phosphate fertilizer as a subsidy to increase rice production.

CONCLUSION

This study shows that acid sulfate can be ameliorated using dolomitic limestone in combination with organic fertilizer for rice cultivation. At a suitable rate of application, rice yield is comparable to that of the granary areas in Peninsular Malaysia.