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CO_2 Emissions from Tropical Peat Soils Affected by Fertilization

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ABSTRACT

The conversion of peat soils to agricultural uses has been thought to increase CO_2 emission due to several factors, including fertilization. However, evidence on the effect of fertilization on CO_2emissionsfrompeat soils is rareand often inconsistence. We measured the effects of different types of fertilizer, including N, P and K sources, and clay as an ameliorant on CO_2 emission from a bare peat soil in Lubuk Ogong, Riau Province. Nutrients were added in the following combinations: 0 (unfertilized plot), N source (urea), slow-release N (slow release urea), N and Psource (Urea+SP-36), N, P and K sources (urea+SP-36+KCl) and combined NPK-Clay. Fertilization resulted in a decreasein CO_2 emissions compared to that prior to fertilization except when slow-release urea was applied. Decreasing of CO_2 emissions was probably due to pH-related effects because the pH in the N treatment was lower than in both the control and the unfertilized plot. A decreasein the level of CO_2 emissions among the treatments followed the order NPK-Clay>NP>NPK>urea>slow-release urea. Covariance analyses showed that the difference in CO_2 emissions prior to treatment was not significant. The application of individual and combined treatments of N, P, K and NPK mixed with 5 Mg ha-1 clay led to significantly reduced CO_2 emissions from bare peat soil in Lubuk Ogong, Riau Province. In addition to fertilization, the water table depth was the only parameter that significantly affected the CO_2 emissions ($P<0.05$). We conclude that the application of nutrient combinations, including N, P, K and clay, could reduce CO_2 emissions because these treatments maintain a balanced nutritional condition in the soil with respect to the microbial activity.

Keywords: Amelioration, CO_2 emission, fertilization, tropical peat soils

ABSTRAK

Konversi lahan gambut menjadi lahan pertanian telah dilaporkan meningkatkan emisi CO 2 yang disebabkan oleh beberapa faktor termasuk pemupukan. Namun demikian, hasil penelitian pengaruh pemupukan terhadap emisi CO 2 pada lahan gambut masih terbatas dan sering tidak konsisten. Dalam kegiatan penelitian ini telah dilakukan penelitian terhadap pengaruh aplikasi pupuk termasuk beberapa sumber hara N, P dan K serta pemberian liat sebagai amelioran terhadap emisi CO_2 pada lahan gambut terlantar di Lubuk Ogong, Provinsi Riau. Unsur hara diberikan dengan kombinasi perlakuan sebagai berikut: 0 (plot tidak dipupuk), sumber N (urea), Pupuk N slow release (urea slow release), Sumber N dan P (Urea+SP-36), sumber N, P dan K (urea+Sp-36+Kcl) dan kombinasi NPK-Liat. Hasil penelitian menunjukkan bahwa aplikasi pupuk di lahan gambut terlantar di lokasi penelitian menunjukkan kecenderungan penurunan emisi CO 2 kecuali pada saat aplikasi urea slow release diberikan. Indikasi penurunan emisi CO 2 tersebut kemungkinan disebabkan oleh perubahan pH tanah akibat perlakuan N dimana pH tanah terendah ditemukan pada plot kontrol dan plot yang tidak dipupuk. Nilai penurunan emisi CO_2 antar perlakuan berurutan dari perlakuan NPK-Liat>NP>NPK>urea>urea slow-release. Namun demikian, analisis kovarian mengindikasikan bahwa perbedaan nilai emisi antar perlakuan tersebut tidak nyata. Pemberian pupuk secara tunggal dan kombinasi N, P dan NPK-liat 5 t ha -1 menghasilkan penurunan emisi CO 2 pada lahan gambut terlantar di Lubuk Ogong, Provinsi Riau. Selain faktor pemupukan, kedalaman muka air tanah adalah salah satu faktor yang paling nyata mempengaruhi penurunan emisi CO 2 (P<0.05). Sebagai kesimpulan adalah bahwa aplikasi kombinasi unsur hara N, P, K dan liat

Kata kunci: amelioran, emisi CO 2 , pemupukan, tanah gambut tropis

INTRODUCTION

Tropical peatlands are considered to contribute greenhouse gas (GHG) emissions that accelerate global warming. High temperature and humidity levels in the tropics provide suitable conditions for