Effect of long-term fertilization on greenhouse gases emission in paddy soils, China

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Two long-term fertilizer experiments initiated in 1980s were used in this study to investigate the effect of rice straw or organic manure application on greenhouse gases (GHGs) emission and soil carbon sequestration. The experiment sites are in Hunan and Jiangxi province with double rice-cropping systems. Methane (CH_4), nitrous oxide (N_2O) and carbon dioxide (CO_2) fluxes were measured in situ using closed chamber method during early rice growing season. Flux of greenhouse gases was monitored at about 7 day's interval. Soil water regime was flooding after seedling transplantation till panicling and drainage during spiking followed by a subsequent moist condition without irrigation till harvest. Treatments in Hunan include CK (no fertilizer), chemical fertilizer only (CF), chemical fertilizer plus pig manure (CFM) and chemical fertilizer plus rice straw (CFS). Jiangxi has the same treatments with Hunan excluding CFS.

Comparing with no fertilizer treatment, fertilization increased soil organic carbon (SOC) content and GHGs emission in both sites. Furthermore, SOC contents in CFM and CFS were significantly higher than CF treatment. In Hunan, total emission of CH_4, N_2O and CO_2 ranged from 45.61 kg CH_4-C/ha to 133.45 kg CH_4-C/ha, from 0.16 kg N_2O-N/ha to 2.11 kg N_2O-N/ha, from 1354.92 kg CO_2-C/ha to 1731.54 kg CO_2-C/ha, respectively. Long-term rice straw return and pig manure application did not increase the total emission of GHGs compared to chemical fertilizer only plot. However, application of pig manure significantly enhanced GHGs emission compared to CF plot in Jiangxi. These results suggest that rice straw return with chemical fertilizer has the potential to mitigate climate change during rice production in Hunan; the effect of organic manure application is highly dependent on soil fertility and climatic conditions.

Determination of phytase labile organic phosphate in organic manure

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In Japan, almost half of the cropland soil is Andosol which is characterized by strong phosphate adsorption capacity. Therefore, crops can't use phosphorus fertilizer efficiently. According to previous research, phosphate in compost is more likely to be efficiently used by crops than chemical fertilizer. This may partly ascribed to mineralization of organic phosphate by micro-organisms. Mineralization of organic phosphate may increase availability of phosphate by crops. Major organic phosphate in organic manure is assumed to be phytic acid, but few report has been analyzed the concentration of the phytic acid in organic manure.

In this study, we tried to determine phytic acid in organic manure using phytic acid hydrolysis enzyme; phytase. Using a commercial wheat phytase, we examined incubation conditions including enzyme concentration, incubation temperature and incubation time, and following method was selected. Finely ground sample (100mg) in a test tube was incubated in 5 ml of 0.04 unit / ml enzyme solution for 12 hours at 30˚C. The enzymatic reaction was terminated with trichloro acid. Inorganic phosphate in the solution was determined by modified malachite