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Lower methane emissions and higher rice yields with lime application

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Liming is a common practice to alleviate soil acidification in agricultural systems around the world. Because liming affects soil microbial activity and soil carbon (C) input rates, it can affect soil greenhouse gas (GHG) emissions as well. However, little is known about the effect of liming on greenhouse gas (GHG) emissions from rice paddies, one of the main sources of anthropogenic CH4. Here, we report on the first experiment to measure the effect of liming on GHG from rice agriculture. We conducted a two-year field experiment to assess the impacts of liming on GHG emissions and rice yield with or without straw incorporation in a double rice cropping system in an acid paddy. Liming significantly reduced methane (CH4) emissions, regardless of straw incorporation, but it did not affect nitrous oxide (N2O) emissions. Lime application significantly enhanced rice aboveground biomass and yield, while reducing the area- and yield-scaled global warming potential of CH4 and N2O emissions. Lime application stimulated soil enzymes activity (i.e. invertase and cellulose) involved in soil C cycling and soil respiration during the fallow season, and reduced the abundance of methanogens during the rice growing season. Together, these results suggest that liming may reduces CH4 emissions by promoting the decomposition of organic matter, thereby reducing C availability for methanogens during the rice growing season. We conclude that, at least in the short-term, liming could be an effective practice to reduce greenhouse gas emissions from acid paddies while increasing rice yield.