Hickman & Rosenzweig Abstract

With substantial increases in fertilizer inputs certain to play a central role in the pursuit of an African "Green Revolution," there is potential for important subsequent impacts on the atmosphere. Increased nitrogen (N) inputs are invariably accompanied by losses of N to the atmosphere as nitrous oxide (N_2O), a greenhouse gas with a global warming potential about 300 times greater than carbon dioxide, and which has also become the leading cause of ozone destruction in the stratosphere. Unfortunately, the relative and absolute effects of different soil fertility management technologies on N_2O emissions remain unclear, as does the basic response of N_2O emissions to different levels of fertilizer inputs. Additionally, scientific investigations of greenhouse gas emissions from sub-Saharan agricultural systems are sparse and incomplete.

In order to expand our understanding of how different tropical agricultural practices affect trace gas emissions and to better understand the relationship between inorganic fertilizer additions and N_2O emissions, we will conduct a series of static chamber measurements in maize research plots near the Millennium Village in Sauri, Kenya. First, we will conduct measurements across a range of fertilization rates in order to construct a response function of trace gas emissions to changes in N inputs throughout the growing season. Secondly, we will measure trace gas emissions under different soil fertility management practices: inorganic inputs, organic inputs, and the use of improved (leguminous) fallows. All measurements will begin before the onset of seasonal rainfall. Since the onset of rains can cause a substantial flux event, will include a wet-up/dry-down experiment before the rains begin to examine the effects of an initial rainfall event on trace gas emissions.

The maize in all plots will be harvested and measured at the end of the season. By comparing changes to production per unit fertilizer as well as changes in GHG emissions per unit production, we may be able to identify important thresholds above which incremental increases in production are accompanied by disproportionate increases in trace gas emissions.