A Study on Methane and Nitrous Oxide Emissions and Mitigation Potentials in Agriculture

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Key Words: agriculture, greenhouse gases, integrated model, technologies, reduction potentials

1. BACKGROUND

There are various Greenhouse gas (GHG) mitigation technologies for agriculture in the world. I developed an integrated model to provide a long-term perspective and a quantitative basis for analyzing the effectiveness of them in agriculture for 23 world regions. The main objective is to quantify the relative importance of major emissions resources and high reduction potentials.

2. INTEGRATED MODEL

This model consists of 3 parts to capture major processes and interactions in both top-down and bottom-up approach (figure 1). "Macro Frame Model" calculates the basic regional information on economic and demographic developments. "Agricultural Trade Model" computes regional consumption, production and trading of agriculture commodities. "Technology Selection Model" is a bottom-up model to calculate the combinations of mitigation technologies economically depending on people's rational selection. This means the number of technologies is determined to minimize the total annualized cost in each year.

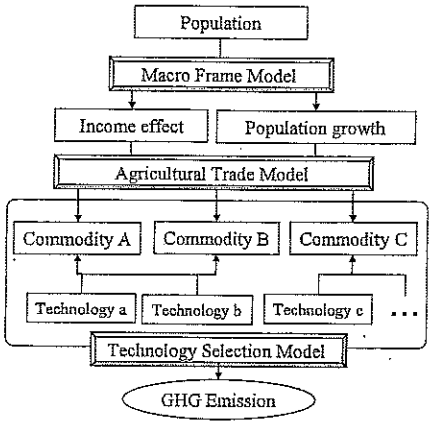

Figure 1 Model flow diagram

3. OUTPUT

World total meat production will increase by 2.1 percent per year between 2000 and 2030. It is higher growth rates than cereal growth rate 1.2 because there is a gradual shift in the demand structure from the main staples to meat products, particularly in the developing countries. Large GHG reduction potentials are estimated in developing regions such as India, China(figure 2). The major emissions resources is cropland soils and livestock's manure management. The options with highest economic efficiency are "Daily spread of manure" and "Reduce fertilization" (figure 3). In the other hand, the lowest efficiency ones were "Fertilizer Free Zone", "Split fertilization".

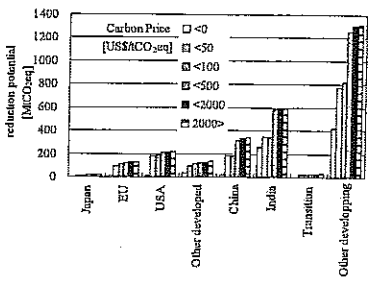

Figure 2 Reduction Potentials by region in 2030

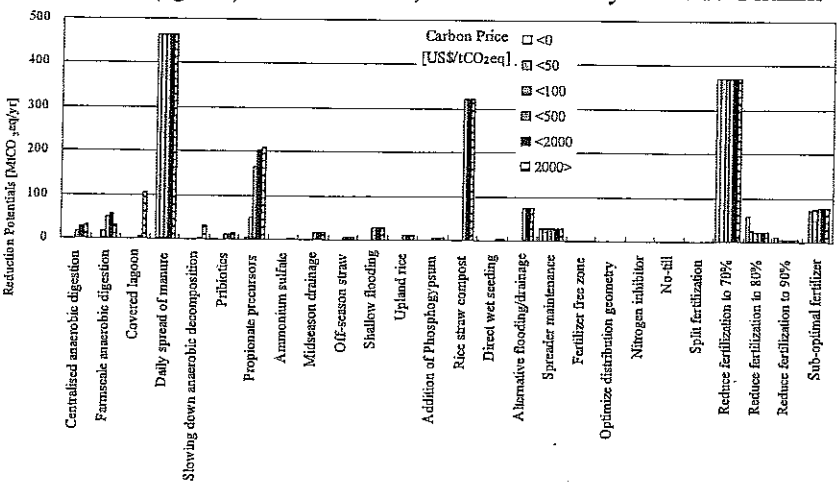

Figure 3 Annual average reduction potentials by technologies by 2030