Estimation of Methane and Nitrous Oxide Emissions from Paddy Fields in Taiwan during 1990 to 2010

Shang-Shyng Yang[1,3], Ching-Piao Liu[2] and Chao-Ming Lai[4]

Departments of [1]Food Science, and [2]Biological Science and Technology,
China University of Science and Technology, Taipei 11581
Departments of [3]Biochemical Science and Technology, and [4]Agricultural Chemistry,
National Taiwan University, Taipei 10617

Abstract

To investigate the greenhouse gases emissions from paddy fields, methane and nitrous oxide emissions were estimated with the local measurement and the IPCC method during 1990 to 2010 in Taiwan. Annual methane emissions ranged from 7,459 to 14,980 ton in the first crop season for 134,038 to 242,298 ha of paddy fields, and they were between 10,709 and 35,208 ton for 92,341 to 211,968 ha in the second crop season with the local measurement for intermittent irrigation. The values ranged from 29,067 to 55,729 ton of methane emissions in the first crop season, and they were between 18,966 and 61,471 ton in the second crop season with the IPCC guideline for continuous flooding. Annual nitrous oxide emissions from paddy fields were between 371 and 728 ton in the first crop season, and the values ranged from 147 to 365 ton in the second crop season with the local measurement. Methane emissions from paddy fields in Taiwan for intermittent irrigation were only 26.72-28.92%, 55.65-57.32% and 41.19-43.10% with the IPCC guidelines for continuous flooding and means temperature of transplanting stage in the first crop, the second crop and total paddy fields, respectively. The values were 53.44-57.84%, 111.29-114.55% and 82.38-86.20% with the IPCC guidelines for single aeration and mean temperature of transplanting stage, respectively; and the values were 133.60-144.61%, 282.56-286.62% and 205.96-215.49% with the IPCC guidelines for multiple aerations and mean temperature of transplanting stage, respectively. Intermittent irrigation in paddy fields reduces methane emission significantly; appropriate application of nitrogen fertilizer and irrigation in paddy fields also decreases nitrous oxide emission.

Key words: Methane, nitrous oxide, paddy field, intermittent irrigation, IPCC.