Non-CO_2 Greenhouse Gases: Methane

Source/Sectors: Agriculture/Rice Cultivation

Technology: Other options for methane reductions - excluding water management (A.3.3.2)

Description of the Technology:
All rice in the United States is grown on flooded fields. One of the most important factors affecting methane emissions is the water management system under which rice is grown. Under continuously flooded conditions, rice fields have higher methane emissions than those that are not flooded. Other factors that influence methane emissions from flooded rice fields include fertilization practices (especially the use of organic fertilizers), soil temperature, soil type, rice variety, and cultivation practices (USEPA, 2006a).

Specific technological options, other than water management, to reduce CH_4 emissions from rice cultivation include:

- Alter the amendments to soils – Adding amendments (e.g., phosphogypsum) to soils to inhibit methanogenesis would reduce methane emissions (Beach et al., 2006; Graus *et al.*, 2004).
- Use of alternative fertilizers – Using an alternative fertilizer (e.g., ammonium sulfate instead of urea) may also reduce methane emissions because sulfate additions to soil can elevate reduction potential, which suppresses methane production (USEPA 2006b; Beach *et al.*, 2006).
- Off-season straw – Shifting straw amendment from in-season to off-season (e.g., apply rice straw two months before rather than in the beginning of rice-growing season) can decrease availability of dissolved organic carbon and, thus, the population of methanogens (USEPA, 2006b).

Effectiveness: Fair

Implementability: Fair

Reliability: Fair

Maturity: Fair

Environmental Benefits: Methane emission reduction.

Cost Effectiveness: None reported.

Industry Acceptance Level: Low

Limitations: May affect the rice production.

Sources of Information:

1. Bates, J. (2001) "Economic Evaluation of Emission Reductions of Nitrous Oxide and Methane in Agriculture in the EU: Bottom-up Analysis", a final report to European Commission.
2. California Energy Commission (2005) "Emission Reduction Opportunities for Non-CO_2

Greenhouse Gases in California", a report prepared by ICF Consulting for California Energy Commissions, CEC-500-2005-121, July 2005.

3. Cole, V.; Cerri, C.; Minami, K.; Mosier, A.; Rosenberg, N. *et al.* (1996) "Chapter 23 – Agricultural Options for Mitigation of Greenhouse Gas Emissions" in Climate Change 1995. Impacts, Adaptions and Mitigation of Climate Change: Scientific-Technical Analyses. IPCC Working Group II, Cambridge Univ. Press.
4. de Jager, D.; Hendriks, C.A.; Byers, C. ; van Brummelen, M.; Petersdorff, C. ; Struker, A.H.M.; Blok, K.; Oonk, J ; Gerbens, S.; Zeeman, G. (2001) "Emission Reduction of Non-CO_2 Greenhouse Gases", Dutch National Research Programme on Global Air Pollution and Climate Change, Report no. 410-200-094.
5. http://www.maf.govt.nz/mafnet/rural-nz/sustainable-resource-use/climate/greenhouse-gas-policies/greengas-14.htm#P1797_148161
6. http://www.maf.govt.nz/mafnet/rural-nz/sustainable-resource-use/climate/abatement-of-agricultural-greenhouse-gas-emissions/abatement-of-agricultural-greenhouse-gas-emissions-19.htm#P4056_323708
7. Leng, R. A. (1993) "Quantitative ruminant nutrition - A green science", Australian Journal of Agricultural Research, 44: 363-80, 1993.
8. Neue, H. (1993) "Methane emission from rice fields: Wetland rice fields may make a major contribution to global warming", Bioscience 43 (**7**): 466-73.
9. U.S. Climate Change Technology Program (2005) "Technology Options for the Near and Long Term", U.S. Department of Energy, http://www.climatetechnology.gov/index.htm, August 2005.
10. U.S. Climate Change Technology Program (2005) "Technology Options for the Near and Long Term", U.S. Department of Energy, http://www.climatetechnology.gov/index.htm, August 2005.
11. U.S. Environmental Protection Agency (1999) "Report on U.S. Methane Emissions 1990-2020: Inventories, Projections, and Opportunities for Reductions", United States Environmental Protection Agency, EPA 430-R-99-013, September 1999.
12. U.S. Environmental Protection Agency (2004) "International Methane and Nitrous Oxide Emissions and Mitigation Data", United States Environmental Protection Agency. Available online at www.epa.gov/methane/appendices.html (in Excel file).
13. U.S. Environmental Protection Agency (2006a) "Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990 to 2004", Office of Atmospheric Programs, United States Environmental Protection Agency, EPA-430-R-06-002, June 2006.
14. U.S. Environmental Protection Agency (2006b) "Global Mitigation of Non-CO_2 Greenhouse Gases", Office of Atmospheric Programs, United States Environmental Protection Agency, EPA-430-R-06-005, June 2006.