

MARCO Workshop

Technology Development for Mitigating Greenhouse Gas Emissions from Agriculture

15 - 18 November , 2011

MARCOワークショップ「農業分野における温暖化緩和技術の開発」

Schedule

- 15 Nov. One day Excursion
- 16 Nov. Scientific symposium
Keynote lectures
Session for livestock
- 17 Nov. Scientific symposium
Session for upland crop fields
Session for paddy fields
Summary session
- 18 Nov. 3rd Paddy Rice Research Group
Meeting, Global Research Alliance
on Agricultural Greenhouse Gases

Venue

Epochal Tsukuba
(Tsukuba International
Congress Hall)
Address : 2-20-3 Takezono,
Tsukuba, Ibaraki 305-0032, Japan



<http://www.niaes.affrc.go.jp/>

Monsoon Asia Agro-Environmental Research Consortium (MARCO)



MARCO members:

Korea: • National Academy of Agricultural Science

China: • Institute of Soil Science

• Institute of Applied Ecology

• Cold and Arid Regions Environmental and Engineering Research Institute

• Inner Mongolia University

Laos: • National Agriculture and Forestry Research Institute

Thailand: • Department of Agriculture

• King Mongkut's Univ. of Technology

Malaysia: • Department of Meteorology

Indonesia: • Environmental Research Institute of South East Asia

• Bogor Agricultural University

Bangladesh : • Bangladesh Agricultural University

India: • National Physical Laboratory

Japan: • National Institute for Agro-Environmental Sciences

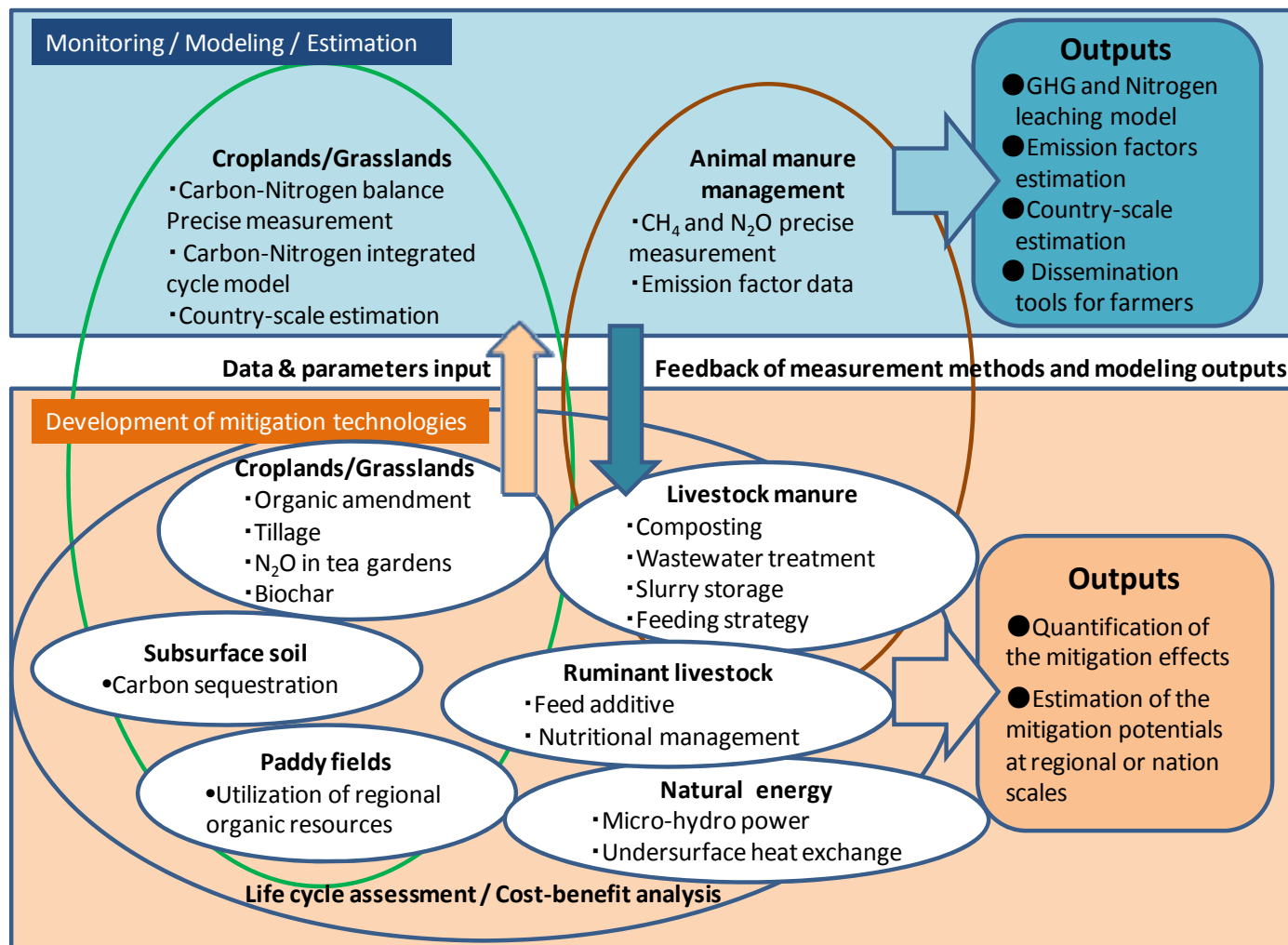
• Environmental Diplomatic Leader Education, University of Tsukuba

Monsoon Asia Agro-Environmental Research Consortium (MARCO)

- 2007 October, Tsukuba: ESAFS-JSSSPN-NIAES-JIRCAS-NARO.NARC-FFTC International Symposium “New Challenges for Agricultural Science : Harmonizing Food Production with the Environment.”
- 2007 October, Tsukuba: NIAES International Symposium 2007 “Invasive Alien Species in Monsoon Asia: Status and Control”
- 2008 October, Tsukuba: Marco Workshop “A New Approach to Soil Information Systems for Natural Resources Management in Asian Countries”
- 2009 September, Nanjing: MARCO Satellite Meeting: International Conference on the Environmental Impacts of Carbon and Nitrogen Cycles in Terrestrial Ecosystems in East Asia
- 2009 October, Tsukuba: MARCO Symposium 2009 “Challenges for Agro-Environmental Research in Monsoon Asia”
- 2010 September, Tsukuba: MARCO/GRA Joint Workshop on Paddy Field Management and Greenhouse Gases
- 2010 September/October, Bogor: MARCO-FFTC International Workshop on Evaluation and Sustainable Management of Soil Carbon Sequestration in Asian Countries
- 2010 November, Tsukuba: MARCO-FFTC International Seminar on Enhancement of Functional Biodiversity Relevant to Sustainable Food Production in ASPAC
- 2011 September, Taipei: MARCO-FFTC International Seminar on Increased Agricultural Nitrogen Circulation in Asia: Technological Challenge to Mitigate Agricultural N Emissions

MAFF funded Research Project (FY2010-2014)

Development of Mitigation Technologies to Climate Change in the Agriculture Sector



Poster Presentation

During afternoon coffee break !

Research project on "Development of mitigation technologies to climate change in the agriculture sector"

A New "Milk Roadmap" in Japan -A Trial Focused on milk production-

Takahisa Hinata, Yoshiaki Kimura
Central Agricultural Experiment Station, Hokkaido Research Organization



Summary

◆ In order to reduce GHG emission in Japan has been required to set an action plan. In UK, The Milk Roadmap was published to reduce environmental impacts including GHG. As a result of stream-lined life cycle assessment (LCA) generated in manure management. This management is one of the most effective.

What is "The Milk Roadmap"

The Milk Roadmap is an action plan for Prod Distribution, and Retail & consumption to reduce GHG emissions from dairy sectors in UK. Japan has been required to set the plan like many years.

Targets for GHG reduction parts, producers, processors



Items & targets for producers

- Environmental stewardship
- Reduction in water use
- Nutrient planning
- Anaerobic digestion
- Manure management plan
- Farm health plans
- New technologies to reduce emissions
- Improving energy efficiency

The Milk Roadmap

- Items on target
- Items now gathering

Result of life cycle inventory

A result of LCA is as below. Emission from accounts for 41-57% of all emission, although cows to digest grasses to a certain extent. Emission related to manure management (m and applied slurry etc from grassland) accounts especially high percentage in regular-scale. Accordingly, it is considered as a bottleneck and developing new techniques in manure management is the most effective way.

Life cycle GHG inventory in 2 type of dairy

	(t-CO ₂ e)	Large-scale farm
Manure Management	96	
Direct emission		
Grassland	28	
Chemical fertilizer	9	
Milking Cows	268	
Chemical fertilizer	27	
Indirect emission		
Purchased feed	44	
total	472	

Contents

Research project on "Development of mitigation technologies to climate change in the agriculture sector"

Model simulation of NO₂- accumulation during swine wastewater treatment

Hirofumi Kawahara¹, Yuuichirou Wakiya¹, Kyouhei Yamasita², Takashi Osada²
¹ Saga prefectural livestock experiment station
² National Institute of livestock and Grassland Science



For prediction of N₂O emission during the wastewater purification, the model simulation was conducted in waste-water could be useful.

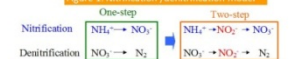
In this study, we extended the basic Activated Sludge Model 3(ASM3) for adapting two-step nitrification-denitrification during the intermittent aeration process in swine wastewater. The measured ammonia, nitrite, nitrate, oxygen conversions and NO₂- accumulation experiment were well described by the expanded model. This result suggest that the model could simulate NO₂- accumulation in wastewater treatment.

Introduction

◆ Nitrite(NO₂) is known to increase the N₂O emission both the nitrification and denitrification.
◆ Consequently, the model simulation of NO₂- accumulation could be useful to predict N₂O emission.
◆ The Activated Sludge Model(ASM) proposed by the International Water Association (IWA) is widely used for biological wastewater treatment processes.
◆ But ASMs can't simulate the nitrite accumulation because ASMs model nitrification/denitrification as one-step process, thus neglecting nitrite as the intermediate(Fig.1).

◆ In this study, we extended the basic Activated Sludge Model 3(ASM3) for two-step nitrification-denitrification(Fig.1), to simulate the accumulation of nitrite during the intermittent aeration process(IAP) treating swine wastewater.

Figure 1. Nitrification-denitrification model



Results and discussion

3.1 Experimental results

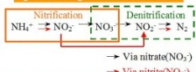
◆ Up to 12 hrs after daily charge, dissolved oxygen(DO) concentration in the waste-water was low(below 1.5 mgO₂/L)(Fig. 4), as a result of the high oxygen consumption for the nitrification(Fig.4) and oxygen substrate was 5 hrs after charge(Fig.4). Fundamentally this NO₂- accumulation occurred for the sensitivities differences between the NO₂- oxidizers and N₂O oxidizers in the low DO condition.

◆ NO₂- accumulation was not observed(Fig.4).
◆ These results suggest that the major nitrogen removal is via nitrite than via nitrate(Fig.3).

3.2 Model evaluation

◆ Figure 4 shows that the measured ammonia, nitrite, nitrate, oxygen conversions and NO₂- accumulation are well described by the model.
◆ These results suggest that the extended ASM3 can simulate the NO₂- accumulation during the intermittent aeration process(IAP) treating swine wastewater.

Figure 3. Nitrogen removal via nitrite



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Research project on "Development of mitigation technologies to climate change in the agriculture sector"

GHG mitigation in animal manure management by feeding strategy and its evaluation from life-cycle perspective

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² Central Agricultural Experiment Station, Hokkaido Research Organization
³ Animal Husbandry Research Institute, Kumamoto Prefectural Agricultural Research Center



Development of Mitigation Technologies of GHGs Emissions from Animal Waste Treatment

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¹ Institute of Livestock and Grassland Science, NARO
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Research project on "Development of mitigation technologies to climate change in the agriculture sector"

Precision measurement of the greenhouse gas in livestock waste treatment process

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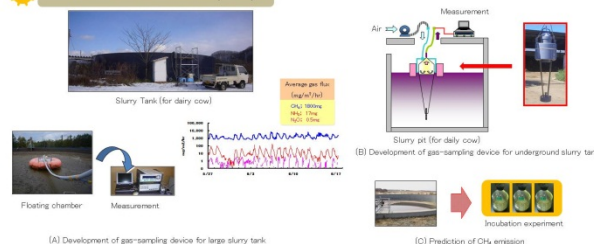


Summary

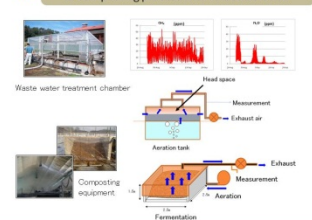
In the recent research, livestock manure has been suspected to contribute significantly to the emissions of methane(CH₄) and nitrous oxide(N₂O). These gases are implicated in environmental concerns such as acid rain or global warming. The few studies so far done have confirmed that greenhouse gases are universally generated from livestock barns and the attendant manure treatment processing. The purpose of this study is to evaluate CH₄ and N₂O emission rates from livestock waste treatment processes. In order to measure the total amount of these gases, we had studied there waste treatment processes below:
1) Emission from the slurry storage of dairy cattle.
2) Emission from the waste water purifications for liquid part of dairy cattle manure and the composting of beef cattle manure.
3) Emission from the solar drying for layer waste.

According to those experimental studies, we are successful for measurement of these gases. In the near future, we will propose high-precision emission rates from livestock waste treatment processes in Japan.

Measurement from stored dairy slurry



Measurement from waste water treatment process & composting process with forced aeration



Measurement from solar drying process

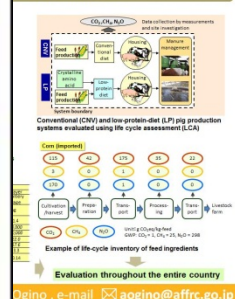
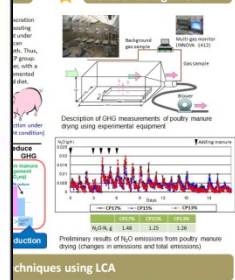


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implemented. Reduction of GHG from low-protein diet supplemented with urea and layer are in progress.

mitigation techniques for animal manure management potential in the entire country.

GHG mitigation in layer manure management



Evaluation throughout the entire country

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Global Research Alliance (GRA)

On Agricultural Greenhouse Gases

GLOBAL
RESEARCH
ALLIANCE

ON AGRICULTURAL GREENHOUSE GASES

- Is a bottom-up international network, founded on the voluntary, collaborative efforts of countries.
- Was launched on December 2009 in the margins of the UN climate change conference (COP15) in Copenhagen, Denmark .
- Now has more than 30 member countries from all regions of the world.
- Brings countries together to find ways to grow more food without growing greenhouse gas emissions.
- See details at:

<http://www.globalresearchalliance.org/>

Research Group Structure

GLOBAL
RESEARCH
ALLIANCE

ON AGRICULTURAL GREENHOUSE GASES

Cross-cutting Groups

Livestock

Cropland

Paddy Rice

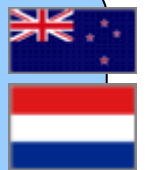


Inventory and
Measurement



Soil Carbon and
Nitrogen Cycling

Research Groups



Key Questions and Objectives

- What we learnt from this Workshop?
- Where do the current research gaps lie?
- How we can challenge to fill the gaps?

MARCO Workshop

On Technology Development for Mitigating Greenhouse Gas Emissions from Agriculture

November 15-18, 2011

Tsukuba, Japan

Official Language:

The official language of the Workshop will be **English**. **However**, voluntary service of simultaneous translation for any monsoon Asian languages are welcome, in particular during the discussion sessions.