

O78-5

[WG5] Mitigating Greenhouse Gas Emissions from Rice Paddy Soils

### Preliminary Studies on Methane Mitigation in Rice Production Systems in Santa Catarina, Brazil

Magda Lima<sup>1</sup>, Domingos Savio Eberhardt<sup>2</sup>, Rosa Toyoko Shiraishi Frighetto<sup>3</sup>, Jose Alberto Noldin<sup>2</sup> and Maria Conceicao Peres Young Pessoa<sup>4</sup>

<sup>1</sup> *Laboratory of Biogeochemistry Brazilian Corporation for Agriculture Research Brazil* G

<sup>3</sup> *Epagri-Estacao Experimental de Itajai Brazil* G

<sup>2</sup> *Laboratorio de Ecologia Quimica Brazilian Agriculture Research Corporation - Embrapa Environment Brazil* G

<sup>4</sup> *Brazilian Agriculture Research Corporation / Embrapa Environment Brazil* GG

G

According to the last national greenhouse gas emission inventory (MCT, 2010), most of Brazil's flooded rice fields utilizes continuous flooding management. Santa Catarina state, Southern region, is responsible for 9.5% of the national rice production (IBGE, 2013). The most usual cropping system is the pre-germinated system, with many cropping areas established in organic soils, with a long period of irrigation. The objective of this study was to evaluate CH<sub>4</sub> emission rates from paddy rice fields adopting pre-germinated system under two types of soils, and to verify the effect of crop management on CH<sub>4</sub> emission.

Experiments were carried out at the Experimental Station of Itajai (Epagri) located at latitude 26° 57'03" and longitude 48° 45'42", in Santa Catarina state, under subtropical climate conditions throughout two consecutive cropping seasons. Two types of soils were studied - mineral and organic, where the mineral soil presented 33% of clay and 2.1% of organic matter, while the organic soil (peat) 28% of clay and 27% of organic matter

In the first season (2006/2007) sowing was performed on 27/Oct/2006, using the cultivar SCS 114 Andosan (density: 120 kg/ha). In the second season (2007/2008) the sowing was performed on 18/Oct/07, with cultivar Epagri 109 (120 kg/ha). In both seasons, N fertilizer topdressing applications totalized a dose of 140 kg urea/ha, divided in 2 applications.

In parallel, another experiment was carried out on the mineral soil area, aiming to compare CH<sub>4</sub> emissions from pre-germinated and sowing on dry soil systems. Conventional tillage was used for the dry soil, with the incorporation of the stubble before the sowing (23/Nov/2007). In the pre-germinated system, the soil preparation was conducted similarly to the first season. The sowing proceeded in 29/Nov/2007 with the use of the cultivar Epagri 109 (120 kg/ha). The area in the pre-germinated system remained continuously flooded during the whole season, while the flooding was established only 20 days after the emergency of the rice in the area sowed on dry soil. The whole area remained flooded until 22 days before harvest, totalizing 95 and 117 days under flooding, for the area sowed on dry soil and pre-germinated, respectively.

Air samplings were carried out weekly in intervals of 5, 10, 15, 20, 25 min. by using aluminum-made chambers (60x60cm) (Sass et al., 1992). CH<sub>4</sub> was quantified in a gas chromatograph HP6890 (Agilent, USA) equipped with FID at 280°C, column megabore (0.53 mm x 30 m 15µm) Plot HP-AL/M, with loop of 0.5 cm<sup>3</sup> maintained at 80°C attached to six-way valve.

In the 2006/2007 season daily average CH<sub>4</sub> emissions registered 465.96 mg CH<sub>4</sub> m<sup>-2</sup> and 819.21 mg CH<sub>4</sub> m<sup>-2</sup> for mineral and organic soil, respectively. Cumulative emissions were estimated in 68.84 g CH<sub>4</sub> m<sup>-2</sup> and 138.21 g CH<sub>4</sub> m<sup>-2</sup> in the respective soils.

In the season 2007/2008 daily average CH<sub>4</sub> emissions registered 361.1 mg CH<sub>4</sub> m<sup>-2</sup> on mineral soil and 398.6 mg CH<sub>4</sub> m<sup>-2</sup> on organic soil, while cumulative emissions were estimated at 55.60 g CH<sub>4</sub>/m<sup>2</sup> on mineral soil and 61.39 g CH<sub>4</sub>/m<sup>2</sup> on organic soil.

The pronounced difference in the values for organic may be associated with the soil preparation conducted in the 2006/2007 season, when all plant mass available was incorporated to the flooded soil just before the rice sowing. Otherwise, in the 2007/2008 season all the stubble was incorporated under drained soil conditions at least 60 days before rice sowing. When considered the crop management systems, cumulative emissions accounted for 61.05 g CH<sub>4</sub>/m<sup>2</sup> on the pre-germinated system and 41.16 g CH<sub>4</sub>/m<sup>2</sup> for sowing on dry soil, whose difference represents a reduction of 32.6% of CH<sub>4</sub> emissions. Daily average CH<sub>4</sub> emissions registered 482.6 mg CH<sub>4</sub> m<sup>-2</sup> on the pre-germinated system and 363.5 mg CH<sub>4</sub> m<sup>-2</sup> on dry soil. Beyond the positive impact in the CH<sub>4</sub> emission, sowing in dry soil conditions reduces the consumption of water without compromising rice productivity.

References:

IBGE. 2013. <http://www.sidra.ibge.gov.br>

MCT. Segunda comunicacao nacional das emissoes de gases de efeito estufa. 2010.

[http://www.mct.gov.br/upd\\_blob/0219/219286.pdf](http://www.mct.gov.br/upd_blob/0219/219286.pdf)

Sass, R. L., F. M. Fisher, Y. B. Wang, F. T. Turner, and M. F. Jund. 1992. Methane emission from rice fields: The effect of floodwater management. *Global Biogeochemical Cycles* 6 (3): 249-262.

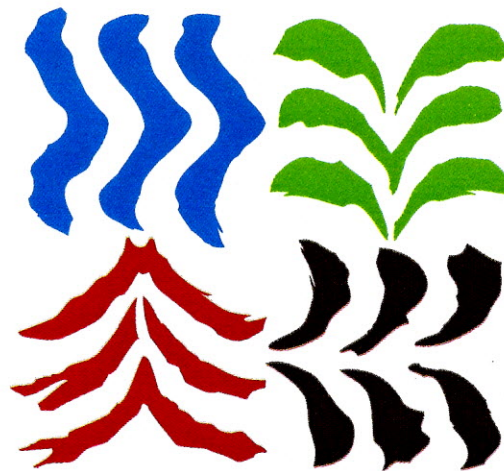
G

**Keywords** *pre-germinated system, CH<sub>4</sub>, Itajai, organic soil, mineral soil* G



# 20<sup>th</sup> WORLD CONGRESS OF SOIL SCIENCE

In Commemoration of the 90<sup>th</sup> Anniversary of the IUSS



Soils Embrace Life and Universe

June 8-13, 2014 Jeju, Korea  
[www.20wcoss.org](http://www.20wcoss.org)

Host



International Union of Soil Sciences



Korean Society of Soil Science and Fertilizer



Rural Development Administration

Support



Ministry of Agriculture, Food and Rural Affairs



MINISTRY OF ENVIRONMENT



Jeju Special Self-Governing Province



KOFST

PROCEEDING



Matthias Kaestner<sup>1\*</sup>, Karolina Nowak<sup>2</sup>, Anja Miltner<sup>1</sup>, Stefan Trap<sup>3</sup> and Andreas Schaeffer<sup>2</sup>  
<sup>1</sup>Helmholtz-Centre for Environmental Research - UFZ, Germany; <sup>2</sup>RWTH Aachen, Germany; <sup>3</sup>Technical University of Denmark, Denmark

## Oral Session No. 78

Halla B (3F)

### [WG5] Mitigating Greenhouse Gas Emissions from Rice Paddy Soils

June 13 (Fri), 13:40 - 15:30

Convenor: Kazuyuki Yagi (National Institute for Agro-Environmental Sciences, Japan)/ Charles W. Rice (Kansas State University, USA)

078-1 13:40 **Considering Stakeholder Perceptions and Institutional Settings for Mitigation Projects in Rice Production**  
 Reiner Wassmann\*, Julie-Ann Basconcillo, Bjoern-Ole Sander and Ngo Duc Minh  
 International Rice Research Institute, Philippines

078-2 14:10 **On-going Research Activities to Mitigate Greenhouse Gas Emission from Paddy Fields in China**  
 Xiaoyuan Yan  
 Chinese Academy of Sciences, China

078-3 14:30 **Effectiveness of Surface Drainage during Fallow Seasons on Mitigating Methane Emissions from Poorly-drained Paddy Fields in Japan**  
 Yutaka Shiratori and Yuichiro Furukawa  
 Niigata Agricultural Research Institute, Japan

078-4 14:50 **Nitrogen and Water Management Practices for Sustainable Rice Production and Reducing Greenhouse Gas Emission**  
 M. Rafiqul Islam<sup>1\*</sup>, Azmul Huda<sup>1</sup>, Md. Rafiqul Islam<sup>1</sup>, M. Jahiruddin<sup>1</sup>, M. Abdus Satter<sup>2</sup>, Yam Gaihre<sup>2</sup> and Upendra Singh<sup>3</sup>  
<sup>1</sup>Bangladesh Agricultural University, Bangladesh; <sup>2</sup>International Fertilizer Development Center, Bangladesh; <sup>3</sup>International Fertilizer Development Center, USA

✱ 078-5 15:10 **Preliminary Studies on Methane Mitigation in Rice Production Systems in Santa Catarina, Brazil**  
 Magda Lima<sup>1</sup>, Domingos Savio Eberhardt<sup>2</sup>, Rosa Toyoko Shiraiishi Frighetto<sup>1</sup>, Jose Alberto Noldin<sup>2</sup> and Maria Conceicao Peres Young Pessoa<sup>1</sup>  
<sup>1</sup>Brazilian Corporation for Agriculture Research, Brazil; <sup>2</sup>Epagri-Estacao Experimental de Itajai, Brazil

## Oral Session No. 79

Samda (3F)

### [C2.3-3] Microbial Biodiversity and Ecosystem Functions in Volcanic Soils

June 13 (Fri), 13:40 - 15:30

Convenor: Jong-Shik Kim (Gyeongbuk Institute for Marine Bioindustry, Korea)/ Gary M. King (Louisiana State University, USA)

079-1 13:40 **Bacterial Community Structures in Rhizosphere Microsites of Lolium Perenne Var. Nui Grown in Chilean Andisol as Revealed by Pyrosequencing**

Lorena Lagos<sup>1\*</sup>, Milko Jorquera<sup>1</sup>, Fumito Maruyama<sup>2</sup>, David E. Crowley<sup>3</sup> and M. Luz Mora<sup>1</sup>

<sup>1</sup>Universidad de La Frontera, Chile; <sup>2</sup>Tokyo Medical and Dental University, Japan; <sup>3</sup>University of California Riverside, USA

079-2 14:05 **Biogeochemical, Cultivation and Molecular Ecological Analyses of Geothermally-heated Soils on Kilauea Volcano, Hawaii**

G.m. King\*, C.e. King and C. Judd  
 Louisiana State University, USA

079-3 14:30 **Temperature Dependency of Soil Nitrogen Mineralization in an Andosol is Affected by Phosphate Availability**

Chihiro Matsuoka, Toru Uno, Ryosuke Tajima, Toyoaki Ito and Masanori Saito\*  
 Tohoku University, Japan

079-4 14:45 **Fungal Translocation of Microelements during Fagus and Quercus Leaf Litter Decomposition in a Volcanic Soil Ecosystem**

Flavia Pinzari\*, Loredana Canfora, Alessandro Florio, Melania Migliore, Barbara Felici, Maria Teresa Dell' Abate and Rosario Napoli  
 Consiglio per la Ricerca e la sperimentazione in Agricoltura. Centro di ricerca per lo studio delle relazioni tra pianta e suolo, Italy

079-5 15:00 **Unravelling the Influence of Plant Cover and Microbial Diversity on Ecosystem Function of Melanic Andosols**

Melania Migliore\*, Loredana Canfora, Alessandro Florio, Flavia Pinzari, Maria Teresa Dell'abate, Anna Benedetti and Rosario Napoli  
 Agriculture Research Council - Research Centre for the Soil-Plant System, Italy

079-6 15:15 **Early Microbial Succession in Recent Unvegetated Volcanic Deposits of Miyake-jima Island, Japan**

Hiroyuki Ohta<sup>1\*</sup>, Reiko Fujimura<sup>1</sup>, Yong Guo<sup>2</sup>, Yoshinori Sato<sup>3</sup>, Tomoyasu Nishizawa<sup>1</sup>, Wataru Suda<sup>4</sup>, Seok-Won Kim<sup>2</sup>, Kenshiro Oshima<sup>4</sup>, Masahira Hattori<sup>4</sup> and Takashi Kamijo<sup>5</sup>  
<sup>1</sup>Ibaraki University, Japan; <sup>2</sup>Tokyo University of Agriculture and Technology, Japan; <sup>3</sup>National Research Institute for Cultural Properties, Japan; <sup>4</sup>The University of Tokyo, Japan; <sup>5</sup>University of Tsukuba, Japan

## Oral Session No. 80

401 (4F)

### [C3.3-3] Ecological Significance of Soil Organic Phosphorus

June 13 (Fri), 13:40 - 15:30

Convenor: Leo Condron (Lincoln University, New Zealand)/ Ben Turner (Lincoln University, New Zealand)

080-1 13:40 **Oxygen Isotopes for Unravelling Phosphorus Transformations in the Soil/plant System: A Review**  
 Emmanuel Frossard\*, Federica Tamburini, Stefano Bernasconi, Verena Pfahler and Christian Von Sperber  
 ETH Zurich, Switzerland

080-2 14:10 **N-fixing Tree Species (Acacia Mangium) Introduced in Eucalyptus Forest Modify Soil Organic P and Low Molecular Weight Organic Acid Pools: A Case Study from Tropical Forest Ecosystem in Congo**