The Effect of Iron-Rich Hot Spring Water on Reduction in Methane Emissions from Rice Cultivation

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Introduction

Background

- 44% of Japan's total methane emissions is from rice paddies
- Methane is 27.0±11 times more potent than carbon dioxide

Key Components of Our Research

- Methanogens produce methane within rice paddies
- Iron interferes with methanogenesis as a competitive electron acceptor

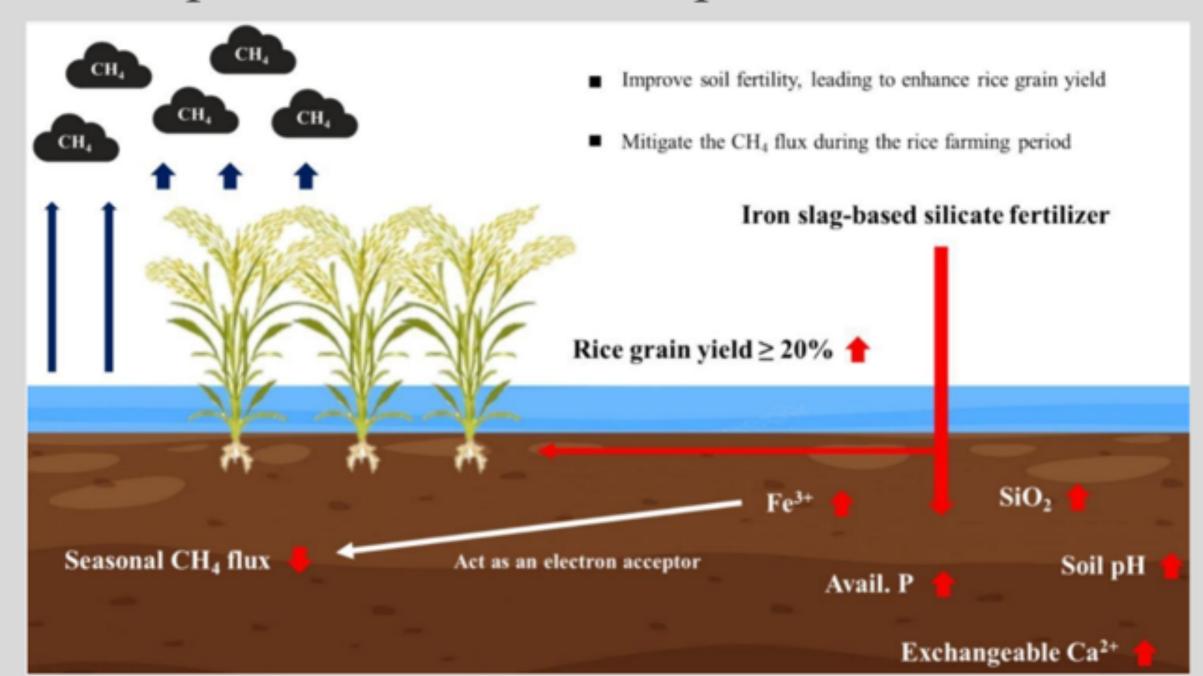


Figure 1. The effect of iron on methane emissions and rice cultivation

Objective

To investigate the effects of iron-rich hot spring water on methane emissions from rice paddies to develop a more sustainable rice cultivation method.

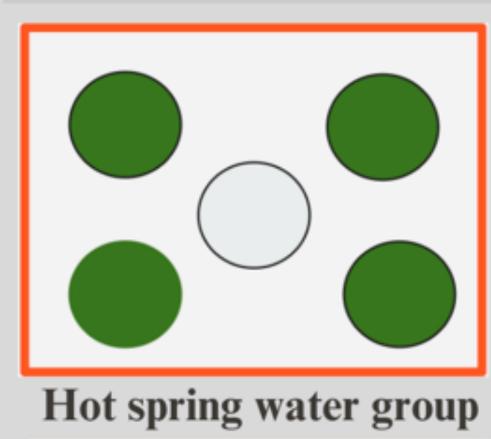
Methodology

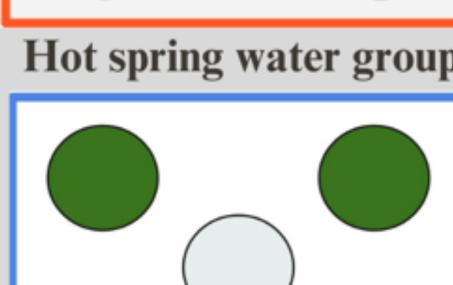
Group 1: Susbstitute tap water for Hot spring water from Yokoya

Group 2: Tap water

Onsen (Nagano)

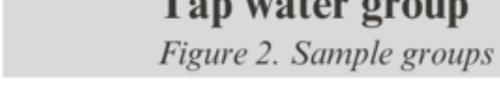
Sampling once a week using "The closed chamber method"

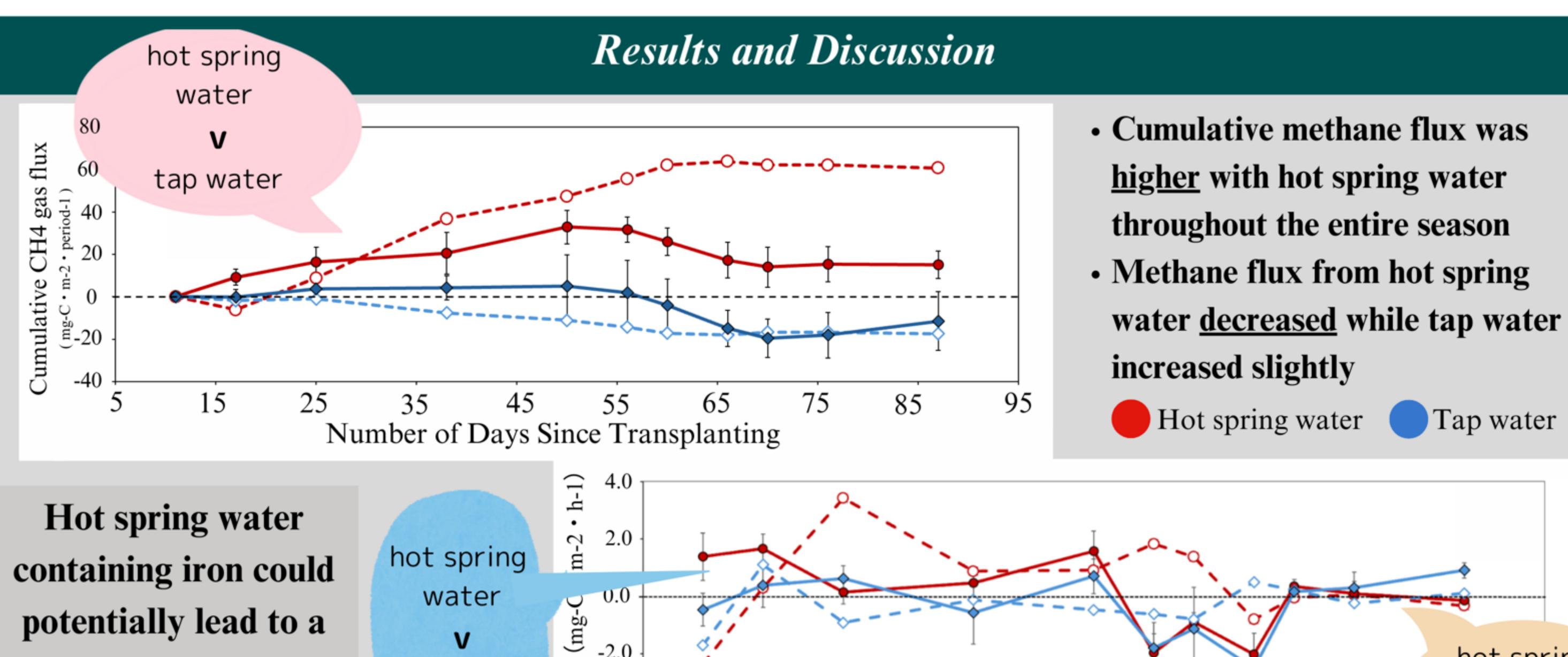




Tap water group

Thermometer Pots with rice → Syringe Pots without rice Rubber Septum 100cm Chamber Box ← Air Buffer Bag 1/2000a Wagner Pot ← 1/5000a Wagner Pot Figure 3. Setup for methane gas sampling





decrease in methane

tap water

-2.0gasflux 15 45 35 Number of Days Since Transplanting

75 Λ tap water

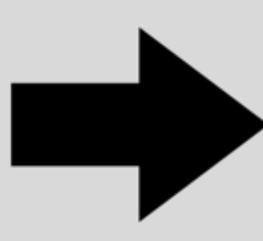
Future works

hot spring

water

Conclusion

Iron-rich hot spring water is worth exploring as a method to reduce methane emissions in rice cultivation.



- Reduction of methane emissions
- Geothermal utilization
- Connects tourism and agricultural industries
- Investigate the mechanisms that cause an increase in methane flux when hot spring water is applied to soil without rice
- Experiment other types of hot spring waters and groundwaters

Sources

- Ali, M. A., Oh, J. H., & Kim, P. J. (2008). Evaluation of silicate iron slag amendment on reducing methane emission from flood water rice farming. Agriculture, Ecosystems & Environment, 128(1-2), 21–26. . Guidelines for Measuring CH 4 and N 2 O Emissions from Rice Paddies by a Manually Operated Closed Chamber Method. (n.d.). https://www.naro.affrc.go.jp/archive/niaes/techdoc/mirsa_guidelines.pdf
- Frenzel, P., Bosse, U., & Janssen, P. H. (1999). Rice roots and methanogenesis in a paddy soil: ferric iron as an alternative electron acceptor in the rooted soil. Soil Biology and Biochemistry, 31(3), 421-430.