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Methane Matters: How Rice Farmers Can Combat Climate Change

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SUMMARY

Rice is major cereal crop which is feeding billions of people all over the world. As cultivation of rice is done under submerged conditions to eliminate other negative effects (weeds) which leads to emission of methane gas over a long period of submergence. Methane is one of the major greenhouse gasses which is responsible for global warming. Hence there is need to cut down the methane gas emission from rice fields which can be made possible by adopting several agronomic practices such as cultivation of methane reducing rice varieties, alternate wetting and drying, optimising fertilizer usage, incorporating organic amendments and switching to dry seeded rice. All the practices help in sustainable crop production by reducing methane emission from submerged paddy fields.

INTRODUCTION

One of the significant constrain in agrifood systems nowadays is rise of greenhouse gas emissions from different sectors leading to climate change. Rice is prime source of carbs which is staple food to half of world population is cultivated over a wide area with different cultivation methods. Submerged rice cultivation which contributes about 88% of total rice cultivation responsible for methane emission. Submergence creates anaerobic conditions which favour emission of CO_2, NO_2 and CH_4. Methane is second major contributor of greenhouse effect after carbon dioxide with GWP of 28 over a 100-year period. Paddy fields contribute about 12% of global anthropogenic methane emission with 50-60 Tg/year emission rate.

Methane production from rice fields

Rice fields under prolonged submergence leads creation of anaerobic conditions which are suitable for methane production from organic matter by methanogenic bacteria is known as methanogenesis, main source of organic matter is rice stubbles. Methane emission from different rice ecosystem follow the order: submerged rice > irrigated rice > rainfed rice. Methane production is enhanced under anaerobic conditions where redox potential is low (-150 mV). Organic matter added to the rice field i.e., rice stubbles is converted in to acetate by bacteria (acetogens) this process is known as acetogenesis. Then reduction of CO_2 using H_2 and transmethylation of acetate leads to synthesis of methane by bacteria (methanogens) is known as methanogenesis. Some amount of methane produced get oxidised to CO_2 and H_2O by methanotrophs at rhizosphere of rice plants and remaining major portion of methane get emitted to atmosphere through aerenchyma tissue of rice plant, ebullition and diffusion through water surface.

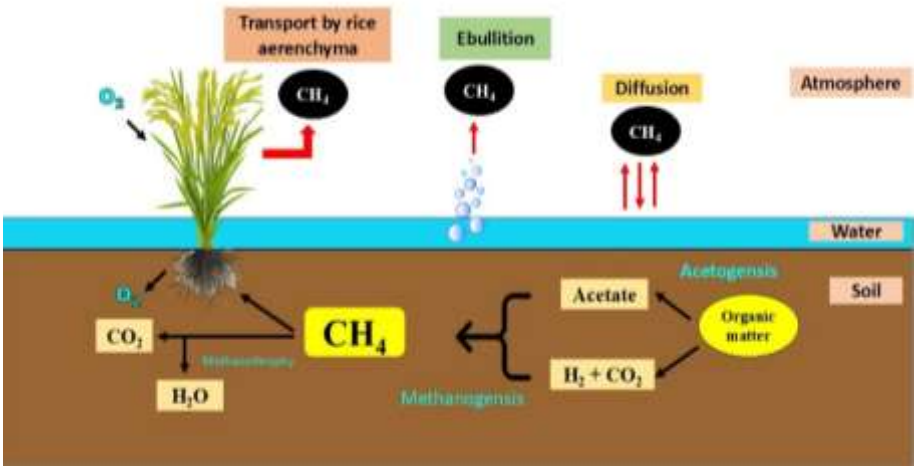

Fig. 1 Methane Gas Production and Emission from Rice Fields

Approaches to reduce methane emission from paddy fields

As the day-to-day population is rising and production is also going high, which leading to rise of greenhouse gas emissions. Hence to maintain food security and environmental sustainability there is need to follow certain approaches to reduce methane emission from paddy fields simultaneously maintaining food security.

1.Water management

Water management practices are the major practices to reduce methane emission from rice fields which include mid-season drainage and alternate wetting and drying (AWD) of paddy field help in enhancing aeration of the soil by supplying O_2 leads to increase of redox potential (Eh) of soil, which ultimately causes reduction of methane emission up to 30-70% from the field without affecting the paddy yields.

2.Soil amendments

Application of nitrification inhibitors like acetylene and nitrapyrin help in reducing methane emission by inhibiting nitrifiers, methanogens and methane oxidizers. Sulphate fertilizers application creates competition between sulphur oxidisers and methanogens for organic carbon hence reduce methane production. Applying of organic matter increase soil aeration and minimise anaerobic conditions but rice stubble incorporation under water logged conditions will enhance methane emission. Application of nitrogen fertilizers should be controlled. Biochar application can also creation soil aeration and minimise methane emission.

3.Cultivar selection

Rice cultivars with special characters to halt methane emission are to be cultivated such as cultivars with undeveloped aerenchyma tissue help in reducing transmission of methane from soil to atmosphere. Varieties having vigour's root growth habit help in soil aeration and root exudates quantity and quality should be considered while selecting the varieties.

4.Direct seeded rice (DSR)

The technique of sowing rice directly into the soil rather than transplanting into puddled soil is known as direct seeded rice. This technique of rice cultivation is gaining high popularity among farmers due to its major benefits like less water requirement, reduce labour cost and early maturity. As there is no water logging conditions it will not create reduced conditions and decrease methane emission by about 47% compared to transplanted rice.

CONCLUSION

Green house gases which are major causes of global warming has considerable effect on crop production. Reduction of methane emission from rice field help in mitigation of climate change can be obtained by adopting above discussed approaches to an extent. To improve adaptation of these management practices there is need of bringing awareness among the farmers regarding advantages on yield and environmental benefits.

REFERENCES

Epule, E. T., Peng, C. and Mafany, N. M. (2011). Methane emissions from paddy rice fields: strategies towards achieving a win-win sustainability scenario between rice production and methane emission reduction. *Journal of Sustainable Development*, *4*(6), 188.

Jang, E. K., Lim, E. M., Kim, J., Kang, M. J., Choi, G. and Moon, J. (2023). Risk management of methane reduction clean development mechanism projects in rice paddy fields. *Agronomy*, *13*(6), 1639.

Neue, H. U., Wassmann, R., Kludze, H. K., Bujun, W. and Lantin, R. S. (1997). Factors and processes controlling methane emissions from rice fields. *Nutrient Cycling in Agroecosystems*, *49*, 111-117.