EFFECT OF CULTIVARS AND SOIL TYPES ON METHANE EMISSION FROM PADDY CULTIVATION

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Introduction

Methane is the second most important green house gas after carbon dioxide. Methane (CH_4) is an important greenhouse gas with a global warming potential approximately 21 times that of carbon dioxide (CO_2). The flooding of rice fields promotes anaerobic fermentation of carbon sources supplied by the rice plants and other incorporated organics, resulting in the formation of methane. Few detailed studies were carried out to investigate methane emission from rice cultivation under different growing conditions in Sri Lanka and still the default values given by the IPCC (Intergovernmental Panel on Climate Change) for total emission calculation is being used. This study was initiated to assess methane emission from paddy farming systems with the specific objective of evaluating different rice varieties and soil types on methane emission.

Materials and Methods

The experiment consisted of six treatment combinations (Two soil types and three rice varieties) arranged in a Complete Randomized Design with three replicates was carried out at Rice Research and Development Institute, Bathalegoda during 2010 Yala season. Rice varieties of Bg 358 (V1), *Sudu heenati* (V2), and Ld-99-12-38 (V3) were grown in RYP (Red Yellow Podzolic soil) (Bathalegoda soil - S1) and NCB (Non Calcic Brown) (Aralaganwila soil - S2) soil types in pots. Methane gas emitted from each pot was collected using locally made chamber at weekly intervals at 9 am,12 noon and 3 pm. Methane was analyzed by using Gas Chromatography at the Institute of Fundamental Studies, Kandy. Gas chromatographic system (Shimatdzu Model 9 AM) equipped with a flame ionization detector (FID) and Thermal capture detector (TCD). Methane emission rate was calculated and expressed as mg m^{-2} h^{-1}.

Results and Discussion

Results showed that the methane fluxes vary in all treatment combinations with plant growth stages. Methane flux was increased with plant growth until it reaches reproductive stage. Slightly higher methane emission was detected at the time of transplanting due to the decomposition of organic matter added (one week before) to pots. Gradual increscent of methane emission was observed with plant growth reaching maximum at heading stage. Thereafter a rapidly decline of emission was recorded. Maximum methane emission rates observed were 782.82 mgm^{-2} 12 h^{-1} day time (**Fig. 1** and **Fig. 2**). Similar results were observed in Kashyap *et al*, (1999) and Hatano *et al.*, (2007). This may be due to the partitioning of current photosynthates more to the reproductive organs thereby decreasing the assimilate available for root exudation causing less

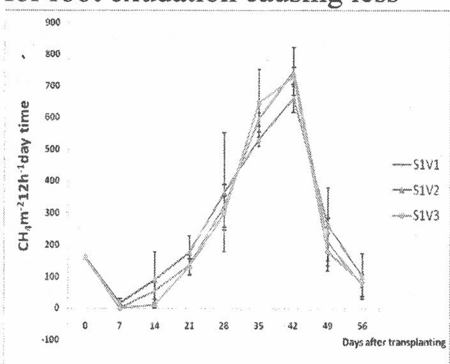

Fig.1 Methane fluxes with days after transplanting in RYP soil

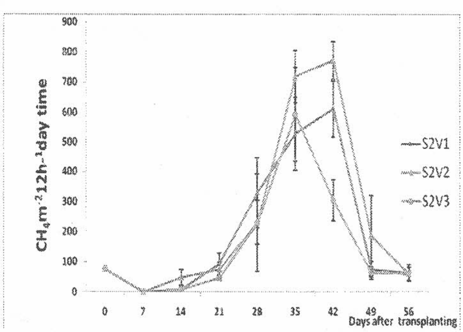

Fig.2 Methane fluxes with days after transplanting in NCB soil

substrate available for the methonogenic bacteria resulting reduced rate of methane emission. There was a variation of a diurnal variation in methane flux in this experiment. Emission rates of CH_4 increases rapidly with sunrise and reaches a peak in the early afternoon.

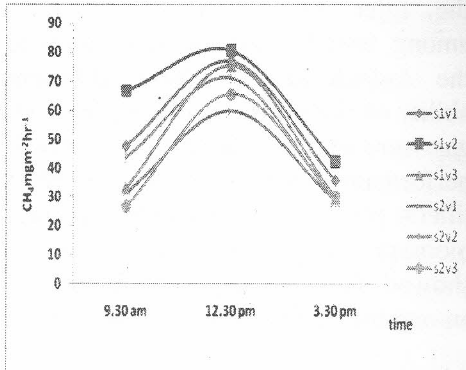

Fig.3 Diurnal variation of methane emission

No significant difference of methane emission among different soil types. This may be associated with similar organic matter content present in two soil types (**Table 1**).

Table.1Soil characters of RYP and NCB soil types

Characteristics	RYP	NCB
EC μscm^{-3}	104.5	65.9
Organic C	0.663%	0.546 %
K(mg/kg)	78.30	41.65
P(mg/kg)	13.5	9.5
N(mg/g soil)	1.074	0.704

Thereafter, rates of CH_4 emission declined rapidly. Due to the high solar radiation and atmospheric temperature, methane fluxes reach maximum peak around 12 noon.

There was no significant difference of methane emission among tested cultivars. Existing Bio mass is the major factor which influences methane emission. Biomass accumulation and the tiller production were similar among tested cultivars. According to the Aulakh *et al*., (2000) different ability of rice cultivars in emitting CH_4 gas were mostly related to the growth performance such as number of plant tillers, plant above and below ground biomass. So results of the study showed the no significant difference among the cultivars due to that reason

Conclusion

Methane emission rates vary with the growth of plants and it showed the highest emission just before the heading stage. Emission rates drastically reduced after fertilization of spikelets and during grain filling stage. Methane emission showed diurnal pattern with increasing emission rates rapidly after sunrise reaching the highest around noon and declining afterwards. Methane emission is not influenced by different cultivars and soil types used in the study. The highest recorded emission rates of 782.82 mgm^{-2} $12h^{-1}$ day time was observed during the flowering stage. Overall results suggest that the CH_4 emission in average was 14.25 gm^{-2} per season.

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