Methane Emission as Affected by Rice Genotypes Under Different Water Management

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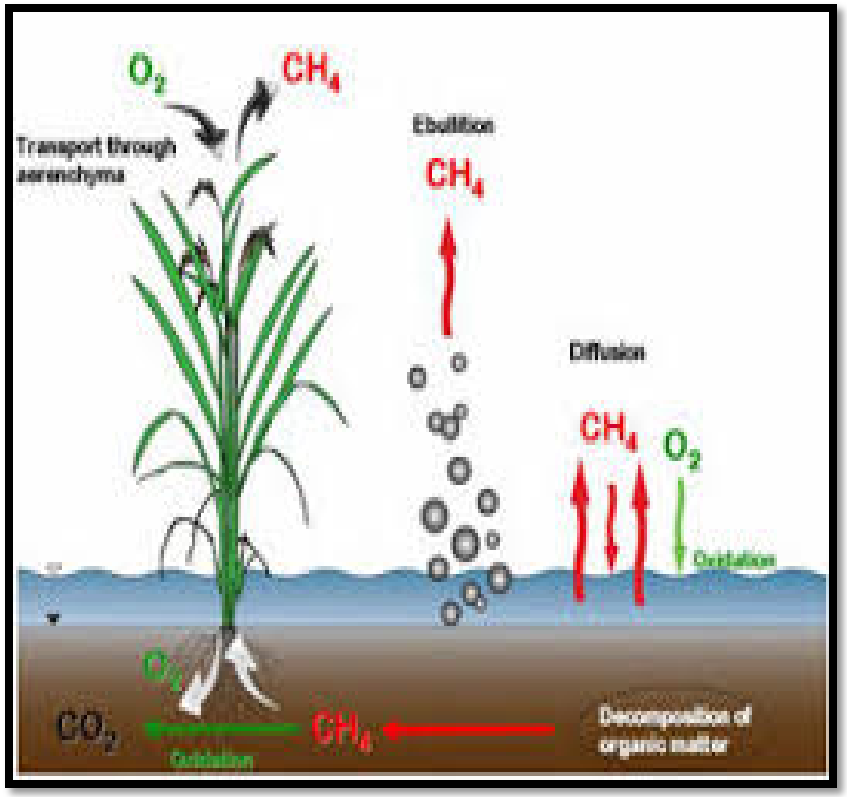
INTRODUCTION



INTRODUCTION

- rice is one of the most important food crops in the world and mostly done in irrigated lowland paddies
- there seem to be a looming water crisis because of climate change impacts
- rice paddies are a major source of anthropogenic methane CH_4, they are responsible for about 15-20% of the annual global efflux

INTRODUCTION (Contd;)

- the continuous flooded method is practiced by local farmers on their paddy field and it does contribute to methane emission and global warming
- due to the scarcity of freshwater resources available for irrigated agriculture and escalating food demand around the world in future, it will be necessary to produce more food with minimum water usage

- need to develop the application of water saving irrigation method on local paddy fields and its effect on reducing methane emission to environment

OBJECTIVES

- To investigate the effect of different irrigation water management and different rice cultivars on methane emission and

- To develop an affective environmental friendly water management technology

MATERIALS AND METHODS

- Season : 2016-2017 Dry season
- Location : Water Utilization Research Section
- **Water Management** :
  - (a) Continuous Flooding (CF)
  - (b) Alternate Wetting and Drying (AWD_{25})

AWD_{25} = Re-irrigated again when water level reaches 25 cm depth in the soil

- **Varieties**
  - (a) Shwethweyin (IR 50)
  - (b) Yadanartoe (Thai 1-9-3E)

Gas sampling and Calculation

Method = Glass Chamber Method

Flux CH4 = $\Delta c/\Delta t$ x V/A x p x 273/(273+T)

Where

$\Delta c/\Delta t$ = the concentration change over time

V = chamber volume (m^3)

A = chamber area (m^2)

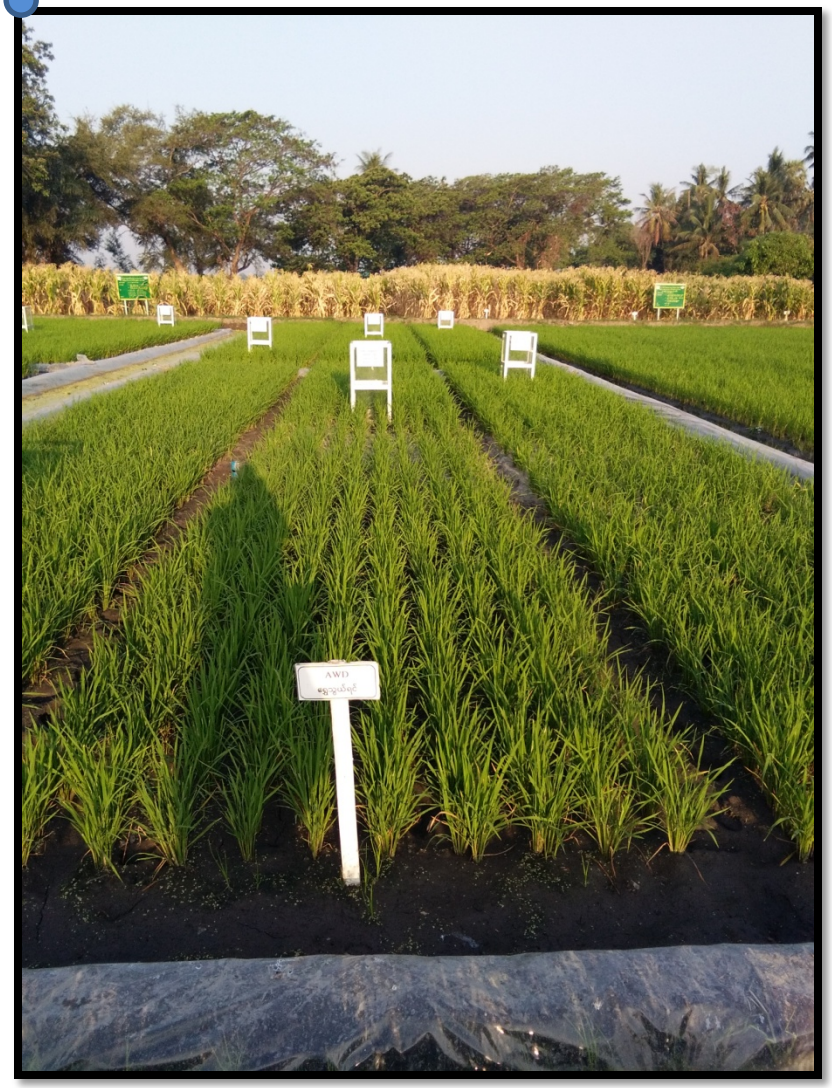
P = gas density (0.717 kg m^{-3} for CH_4)

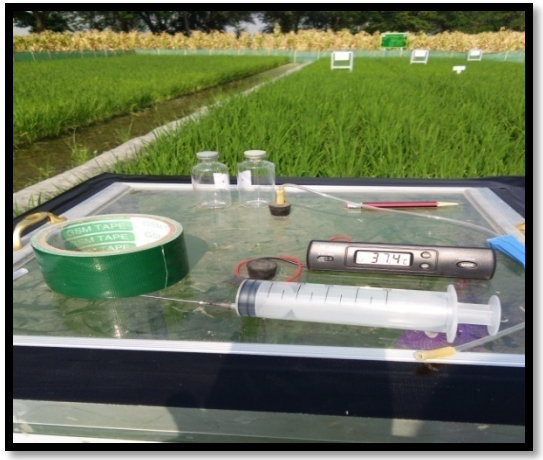
T = the mean air temperature inside the chamber (C)

DATA COLLECTION

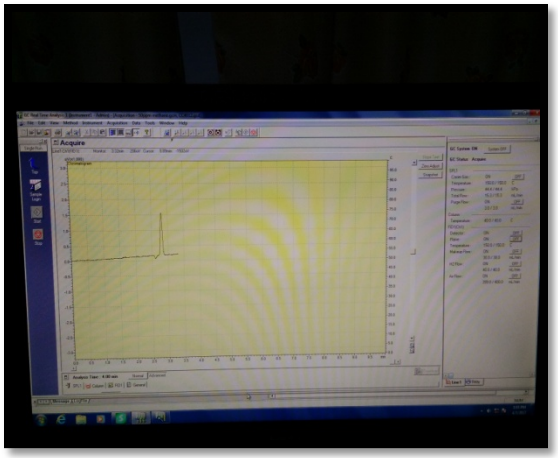
1) CH_4 gas emission
2) Rice yield and yield component
3) Leaf Area (LA)
4) Leaf Area Index (LAI)
5) SPAD meter reading
6) Harvest Index (HI)

RESULTS AND DISCUSSION





Measuring CH_4 Gas Sample



The CH4 emission form flooded paddy field was 74% higher than non-flooded paddy field (P.K. Lo et al., 2016)

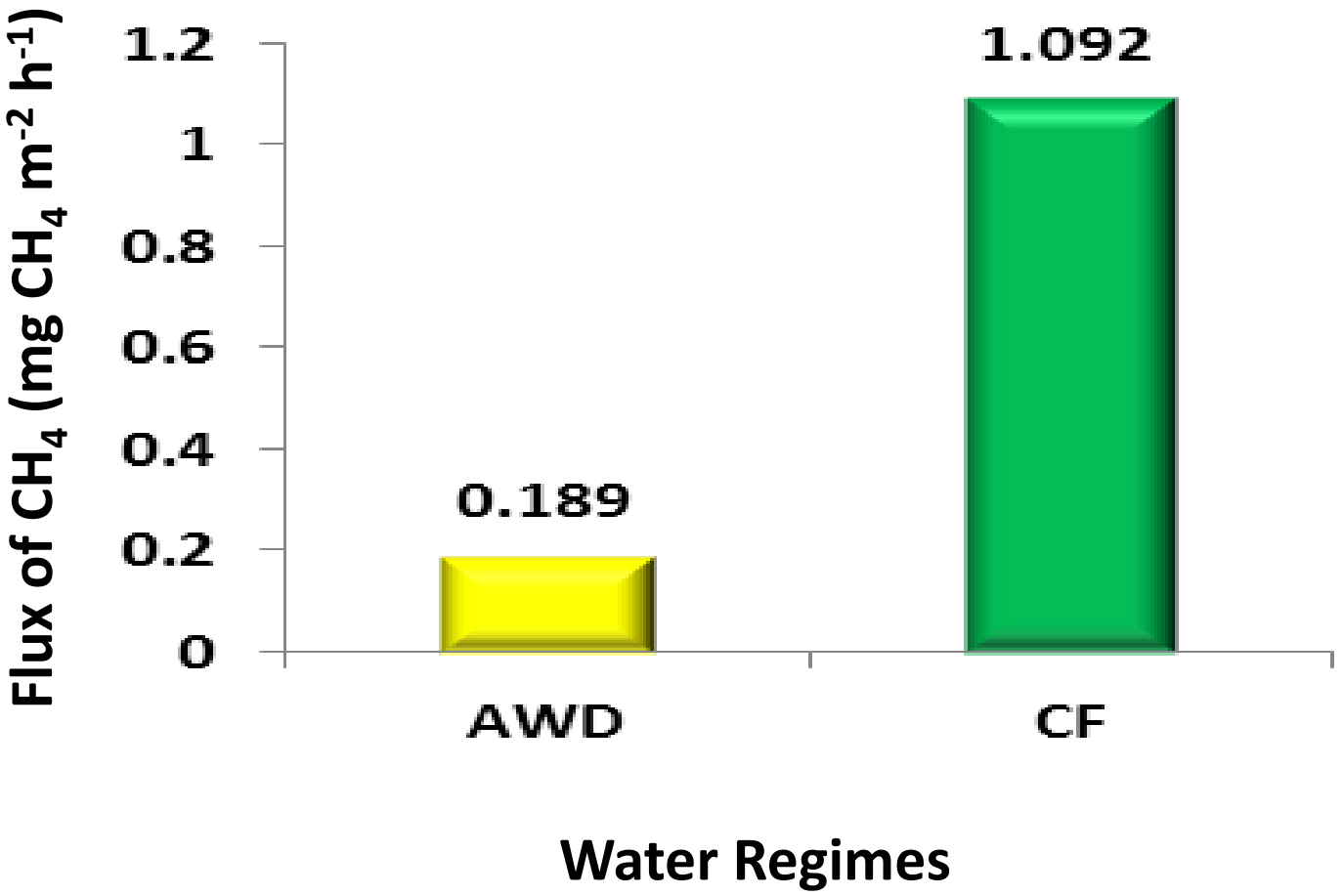


Figure (1) Methane flux of different water regimes

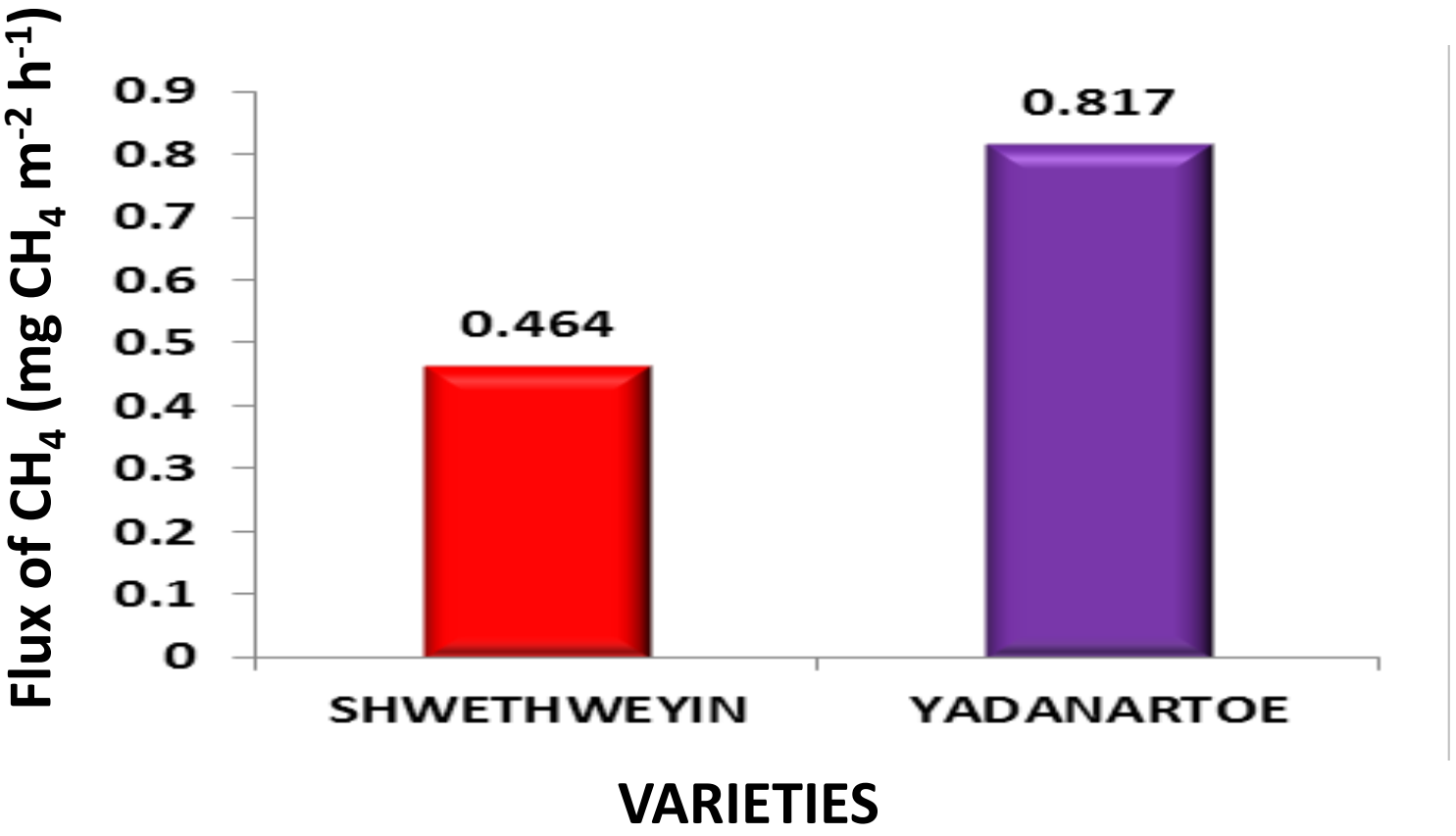


Figure (2) Methane flux of different varieties

All of the results agree with the report of Wassmann et al., 2000 increasing the temperature during the middle of the cropping season lead to highest emission during the reproductive stages

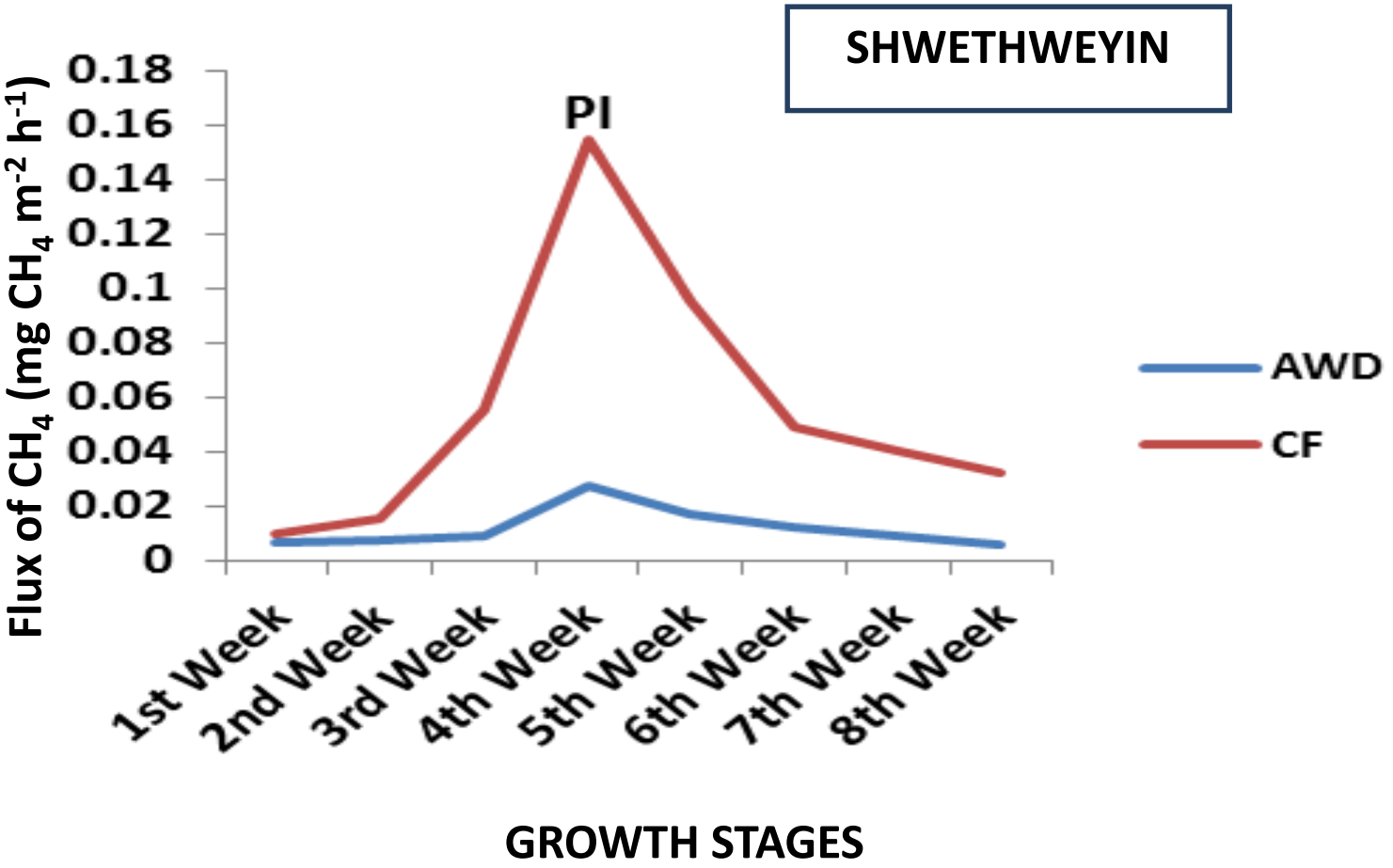


Figure (3) Observed and simulated CH4 emission at growth stages

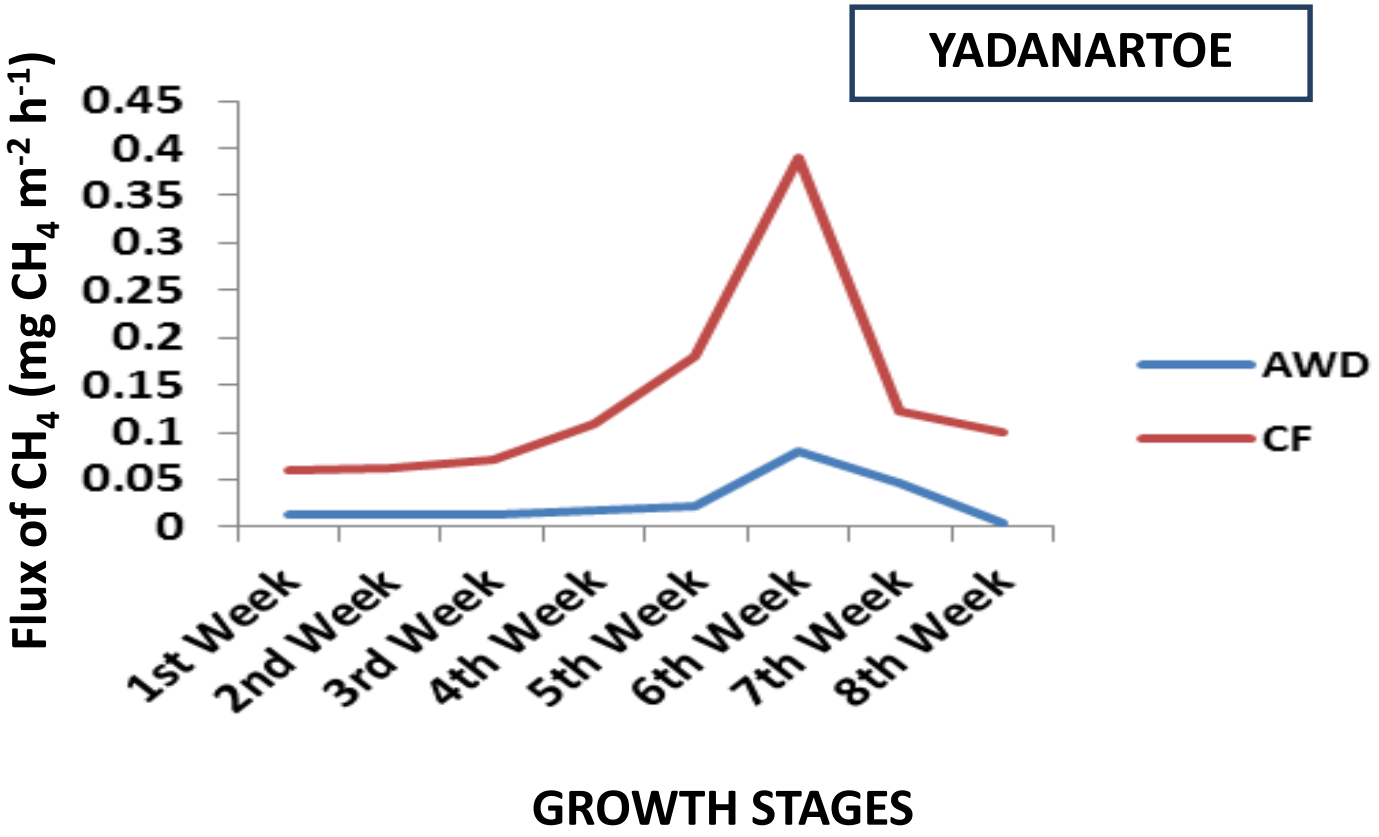
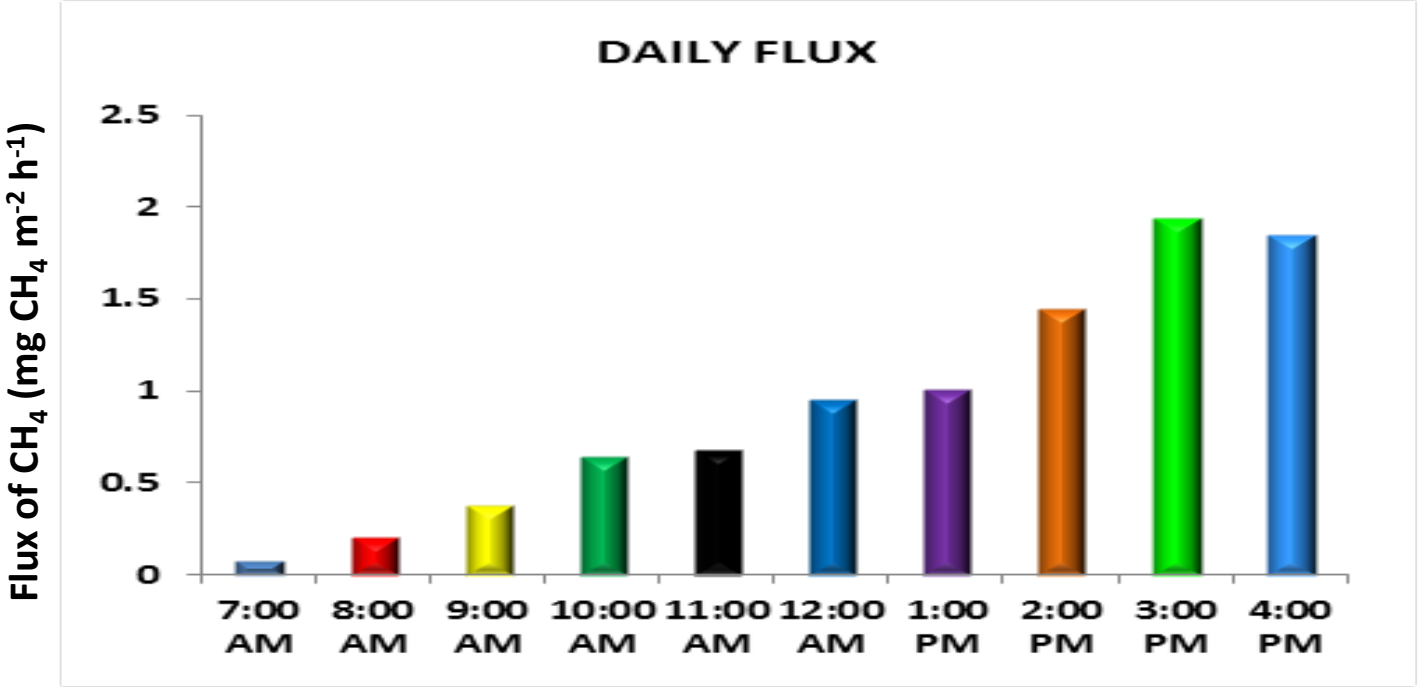


Figure (4) Observed and simulated CH4 emission at growth stages



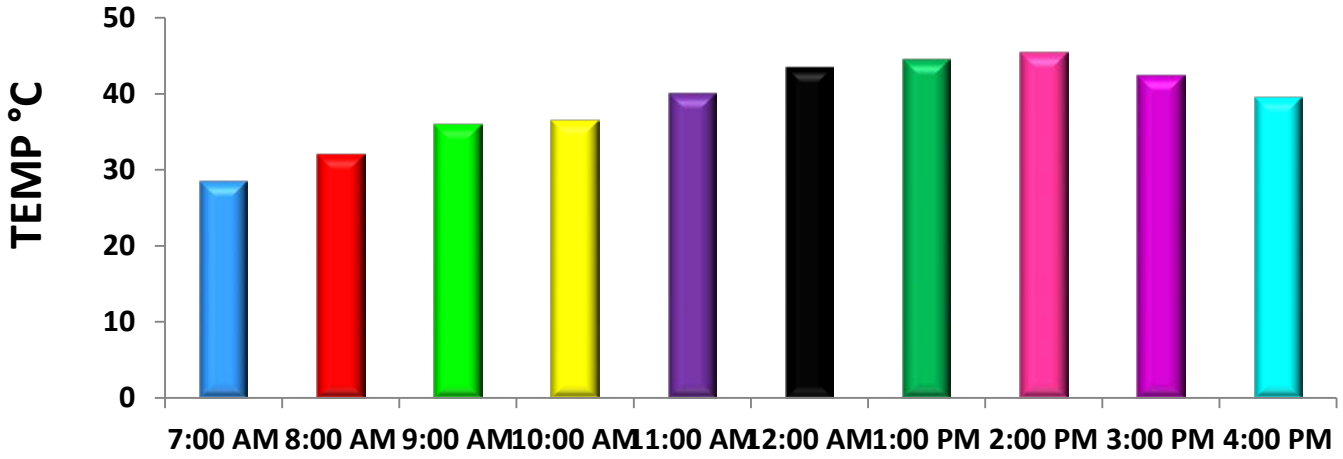


Figure (5) Methane flux for paddy field in different temperature (°C)

Table 1. Means of Effective Tiller, Leaf Area, Leaf Area Index and SPAD reading as influenced by water regimes

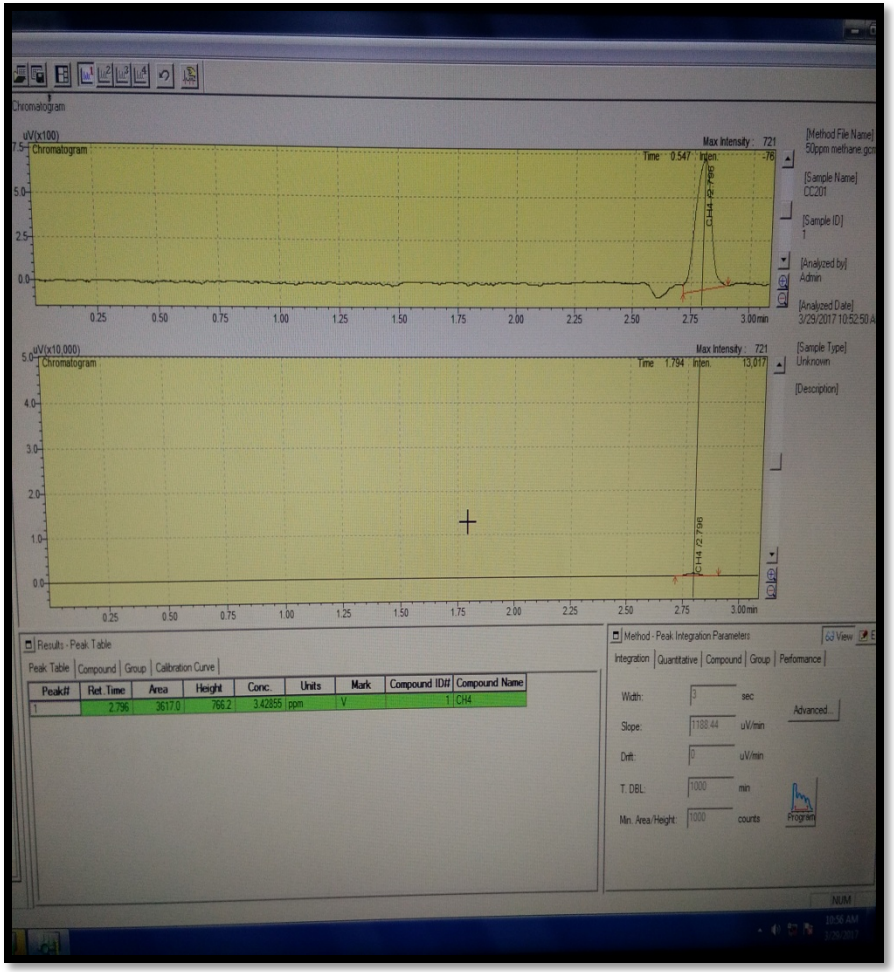
No.	Characters	Water Regimes		F-test
		Continuous Flooding	Alternate Wetting & Drying	
1.	Effective Tillers	20.54	20.88	ns
2.	Leaf Area (cm^2)	2354.55	2194.34	ns
3.	Leaf Area Index	5.70	5.21	ns
4.	SPAD Meter Reading	39.82	39.22	ns

Table 2. Means of Biomass Weight, Yield, Harvest Index and Water Use Efficiency as influenced by water regimes

No.	Characters	Water Regimes		F-test
		Continuous Flooding	Alternate Wetting & Drying	
1.	Biomass Weight (g)	59.46	63.88	ns
2.	Yield (bsk/ac)	121.54	119.78	ns
3.	Harvest Index	0.45	0.42	ns
4.	Water Use Efficiency (g/l)	1.09	1.40	ns
5.	Total Water Use (mm)	584.2	447.07	1 %

CONCLUSION


GAS SAMPLER
CHARGE
DISCHARGE
CLOSE OPEN CLOSE OPEN
IN
OUT


Chromatogram
Results - Peak Table
Peak Table | Compound | Group | Calibration Curve
Peak# | Ret. Time | Area | Height | Conc. | Units | Mark | Compound ID# | Compound Name
1 | 2.796 | 3617.0 | 766.2 | 3.42855 | ppm | V | 1 | CH4
Method - Peak Integration Parameters
Integration | Quantitative | Compound | Group | Performance
Width:
Slope:
Drift:
T. DBL:
Min. Area/Height:
Advanced...
Program

CONCLUSION

- Water saving irrigation technique (AWD) not only could save irrigation water but also methane emission without significant yield loss as compare to farmer practice
- Water level for paddy field played an important role on methane emission rate. The methane emission from farmer practice field was 60-70% higher than water saving paddy field
- The conventional water irrigation method of paddy field could contribute to methane emission significantly

CONCLUSION

- Moreover, amount of methane emission from long life rice genotype was higher than short life rice genotypes
- Compare to previous finding, methane emission from paddy field in pre-monsoon season was higher than monsoon rice because of high temperature in this season

FUTURE PLAN

- The combined impacts of different soil types and fertilizer materials on CH_4, CO_2 and N_2O emission as potential GHG mitigation strategies
- CH_4 and CO_2 emission effect on Rice Ratooning ability (SALIBU Technology)
- Emission of CH_4 and CO_2 from paddy field as affected by tillage practices and crop residue

Thanks for kind attention