



Effect of long-term application of fertilizers and manures on methane emission during rice cultivation

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Objectives of the study

- ▶ **To measure the seasonal methane emissions from rice fields in Punjab state of India.**
- ▶ **To study the effect of long-term application of fertilizers and manures in rice-wheat cropping system on methane emissions during rice cultivation.**



Treatments

Treatment	Fertilizer/manure/straw
T1	100 % NPK from chemical fertilizers
T2	150 % NPK from chemical fertilizers
T5	100 % N only from chemical fertilizers
T7	100 % NPK from chemical fertilizers + straw @ 10 ton ha ⁻¹
T9	100 % NPK from chemical fertilizers + FYM@ 6 ton ha ⁻¹
T11	100 % NPK from chemical fertilizers + Green Manure (<i>Sesbania sp.</i>)
Control	No application

100% NPK: 120 kg N, 26.2 kg P₂O₅, 25 kg K ha⁻¹

Assembling of gas collection chambers and bases

Gurcharan



Self



Chamber Base



Sampling in rice



Working on Gas Chromatographer



Gas chromatographer: Shimadzu 2010

Nitrogen generator: NAG 01A

Hydrogen Generator: HSS01

Injector:

Mode : Split

Temperature : 150°C

Carrier gas : N2/air

Column- RT-QPLOT

Length : 30 m

Inner dia : 0.53 mm

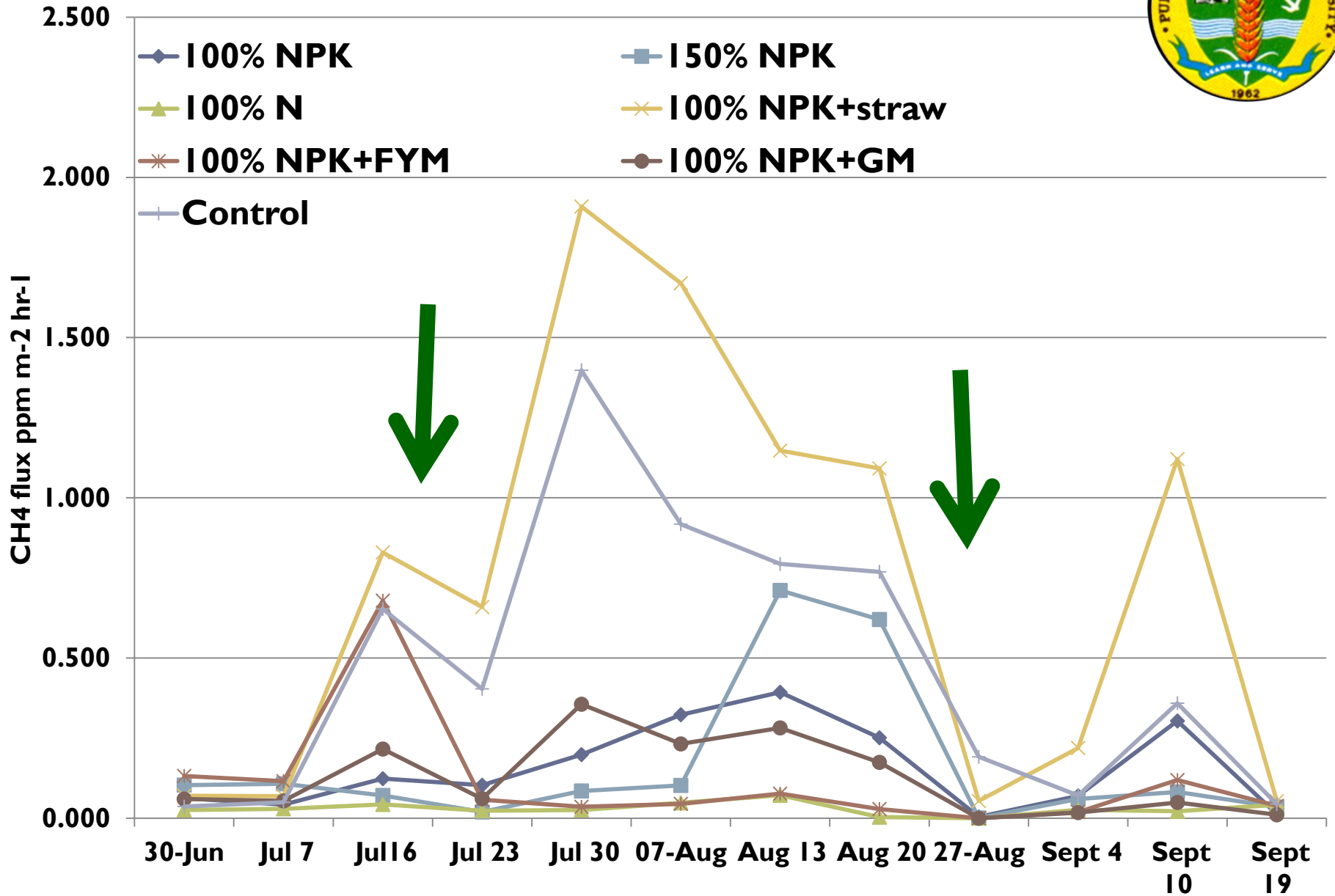
Temperature : 60°C

Total time : 4 min

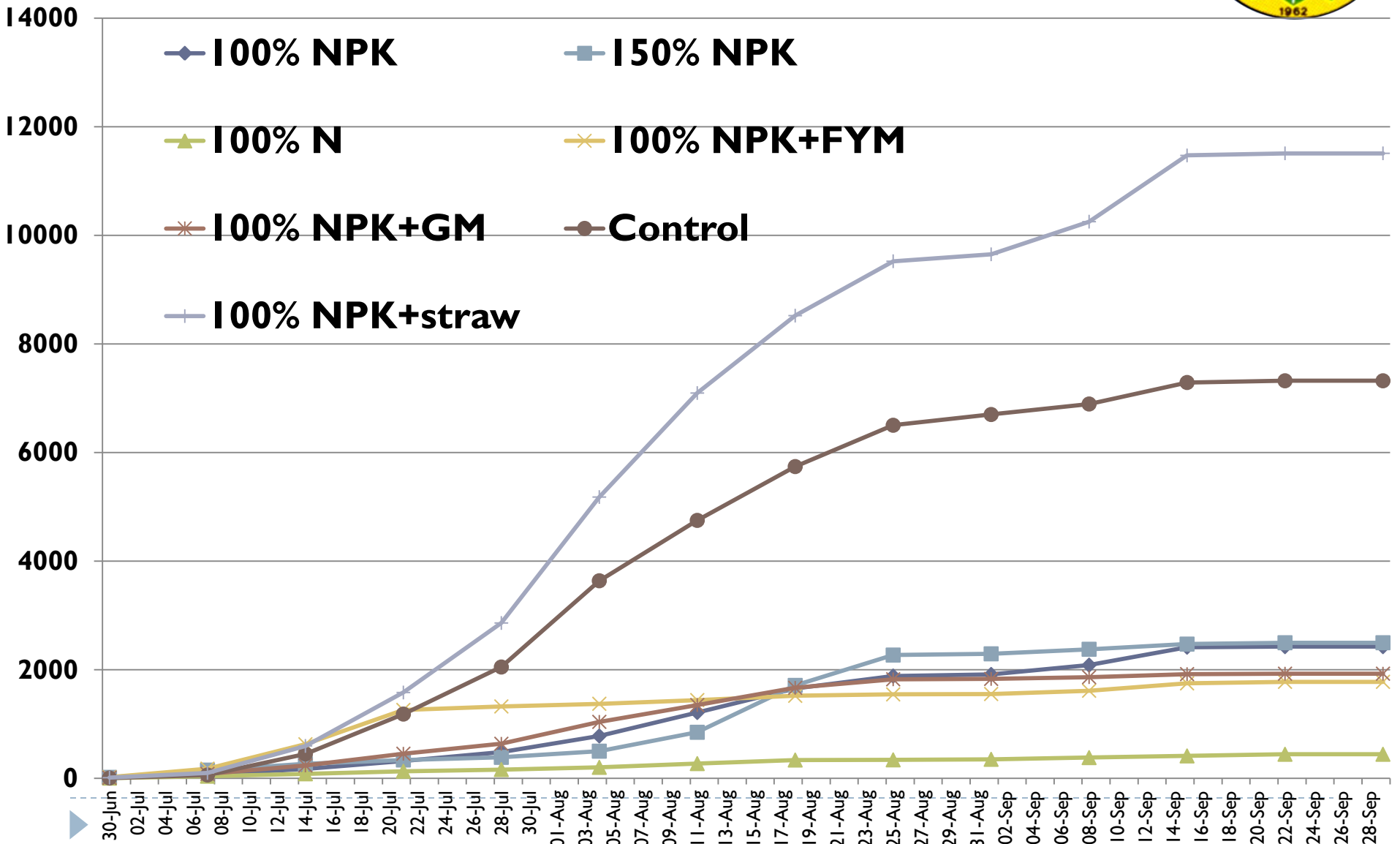
Detector

Chanel 1 FID

Methane flux from rice fields

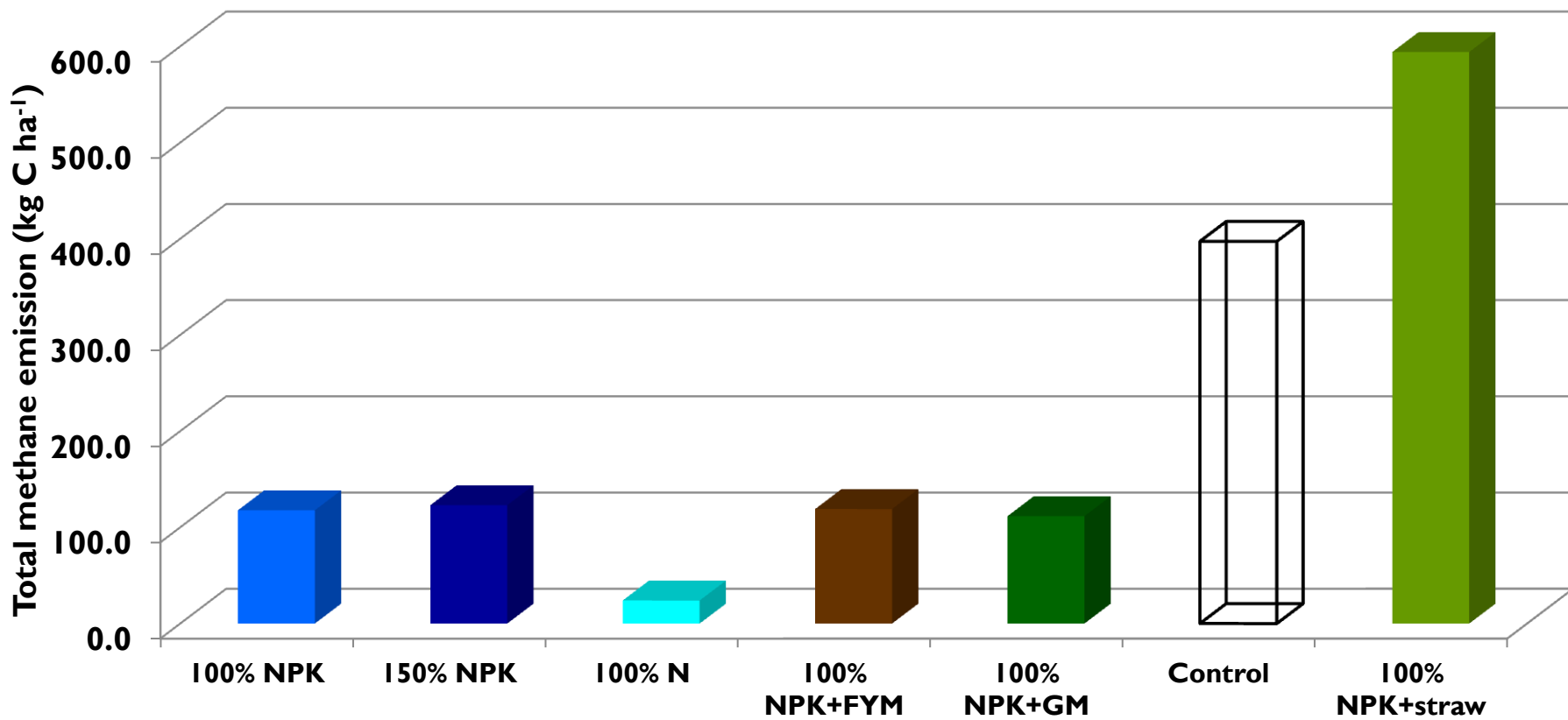


Cumulative methane flux from rice fields (gm C ha⁻¹ day⁻¹)



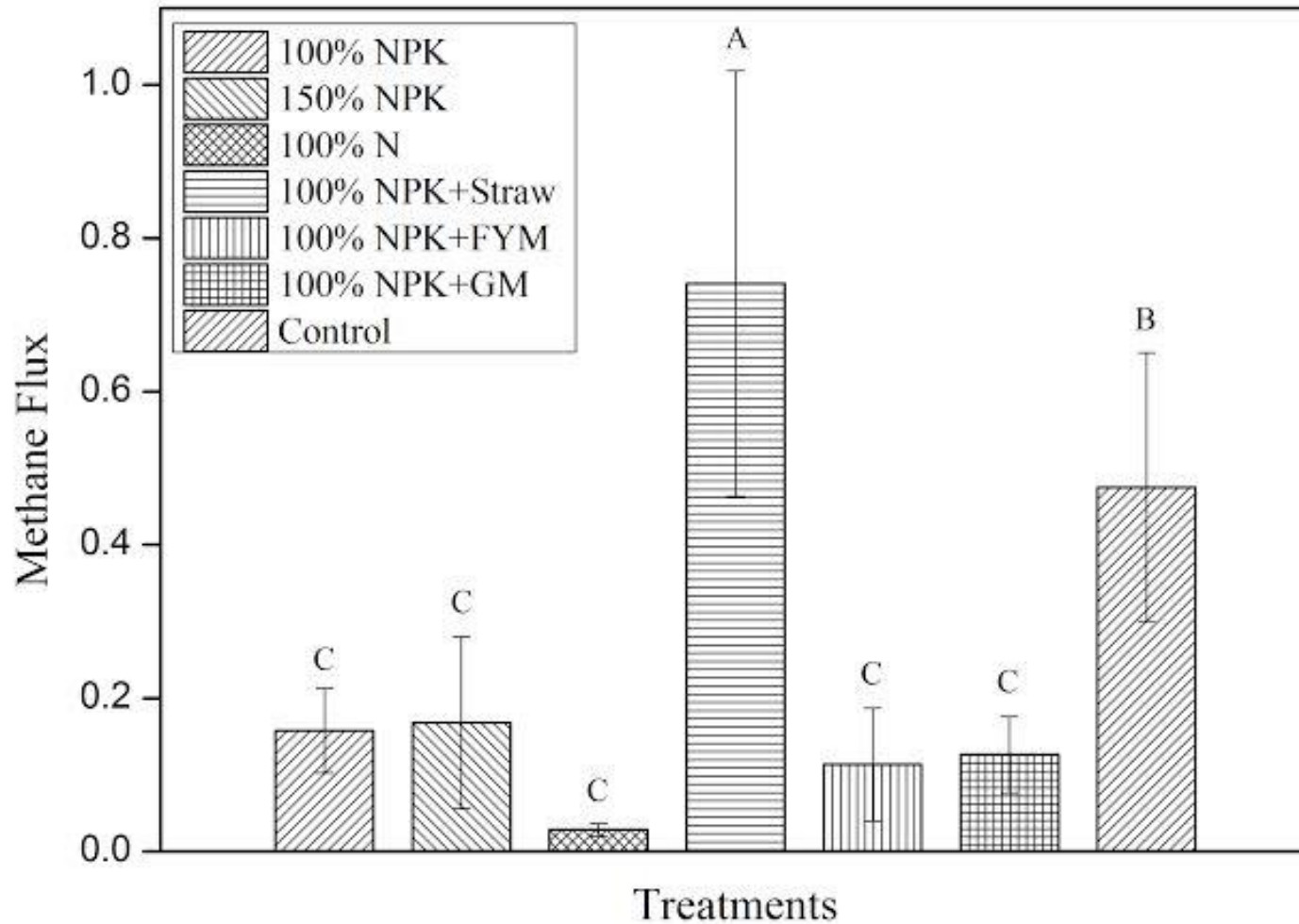


Effect of long-term application of fertilizers and manures in rice-wheat cropping system on total methane emission during rice cultivation





Treatment effect & CH₄ emission





Soil Carbon

Treatment	OC %	Total % C	Total % N	Non-Labile C
100% NPK	0.328	0.367	0.051	0.039
150% NPK	0.360	0.398	0.055	0.038
100% N	0.332	0.379	0.045	0.047
100% NPK+straw	0.536	0.625	0.046	0.089
100% NPK+FYM	0.568	0.675	0.069	0.107
100% NPK+GM	0.446	0.624	0.053	0.178
▶ Control	0.444	0.449	0.039	0.005



Rice grain and straw yield ($T\ ha^{-1}$)

Treatment	Grain Yield (t/ha)	Straw Yield (t/ha)
100% NPK	6.41	8.08
150%NPK	7.90	8.41
100%N	5.82	6.36
100%NPK+Straw	7.15	8.06
100%NPK+FYM	7.93	9.14
100%NPK+GM	8.19	8.69
Control	4.69	5.09
CD	0.74	0.76



File Name	Date Modified
Dundek P 2011 methods of plant root exudates analysis_ a review	27/12/2013 06:04
Infrared_Spectroscopy_Fundamentals_and_Applications_4_Organic_Molecules	27/12/2013 04:29
Krzyszowska A J, Blaylock M J, Vance G F and David M B 1996 Ion-chromatographic analysis of low molecular weight organic aci...	27/12/2013 04:12
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ion chromatography 1	26/12/2013 22:46
Masayuki Tani 2001 Determination of water-soluble low-molecular-weight organic acids in soils by ion chromatography	26/12/2013 07:04
Yan Zhu1997 Simultaneous determination of carbohydrates and organic acids in beer and wine by ion chromatography	26/12/2013 07:02
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Baziramakenga R 1995 Determination of organic acids in soil extracts by ion chromatography	26/12/2013 06:42
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Pore water samplers slides	24/09/2013 09:25
UMS-Pore-Water-Sampler_0	24/09/2013 09:17
M1-1252_53e Suction cups	24/09/2013 09:15
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Lu Yahai 2000 Dissolved organic carbon and methane emissions from a rice paddy fertilized with ammonium and nitrate	22/09/2013 11:38



- ▶ **High methane emissions in control could be attributed to higher excretion of root exudates by plants under nutrient stresses.**
- ▶ **Root exudates are simple sugars, susceptible easy decomposition**
- ▶ **In-situ study required to:**
 - ▶ estimate soil solution organic carbon
 - ▶ simultaneously recording methane emission

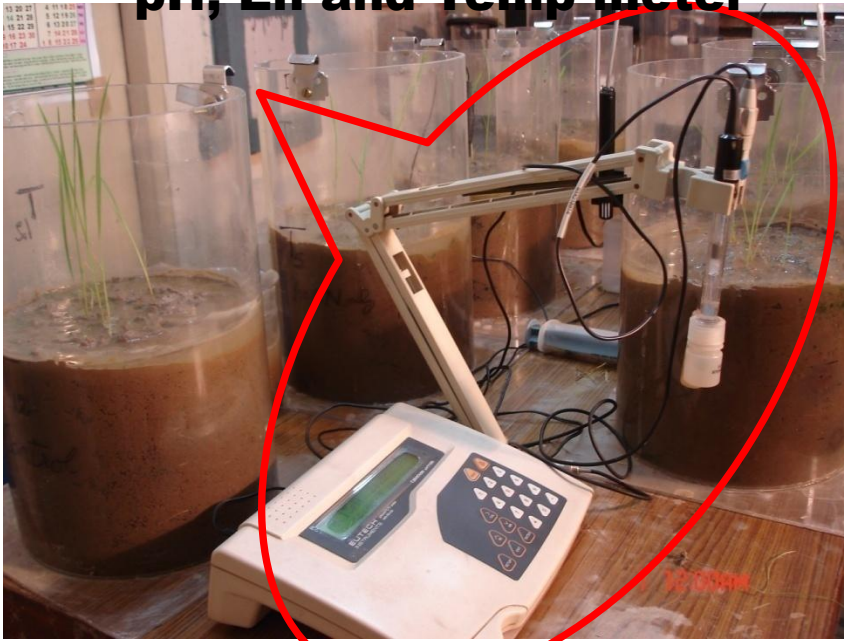




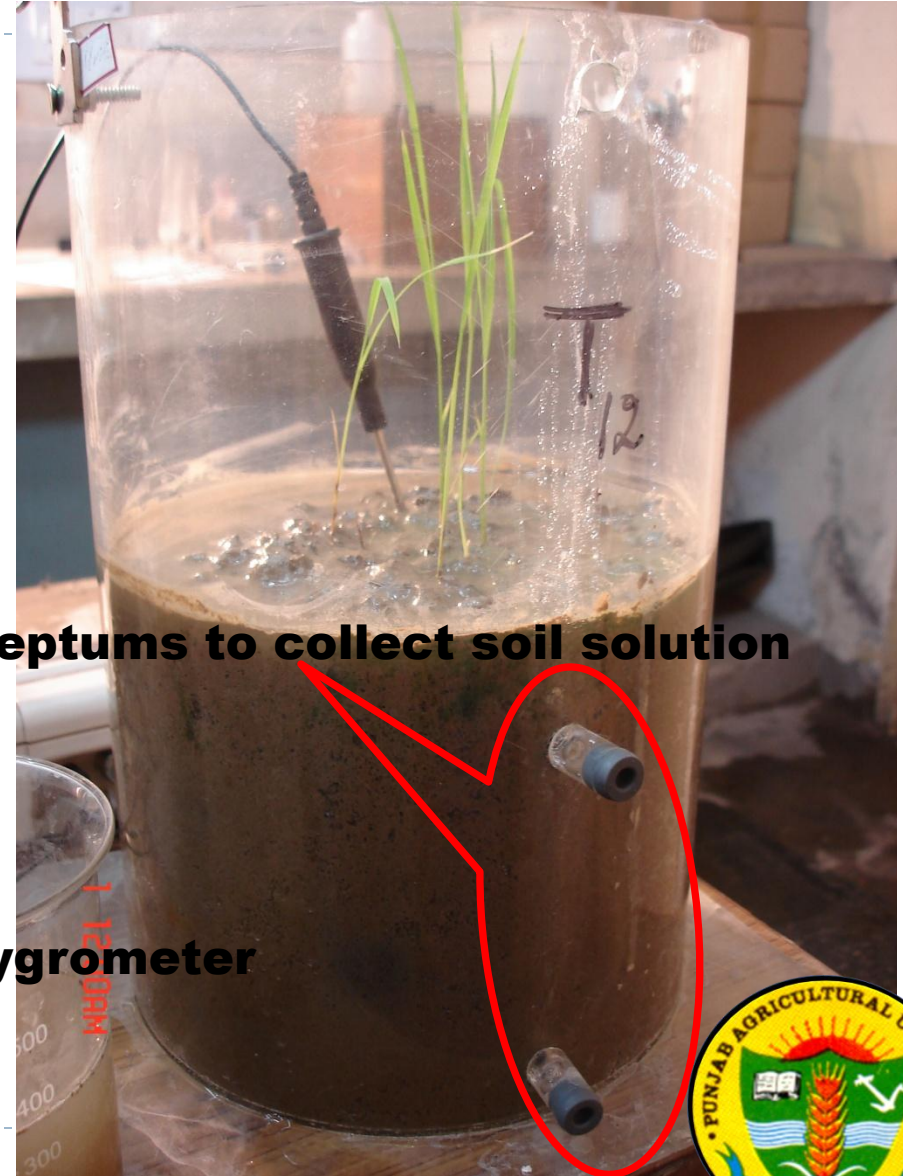
Cups to collect soil solution

Lab study to measure CH₄ fluxes and soil carbon dynamics

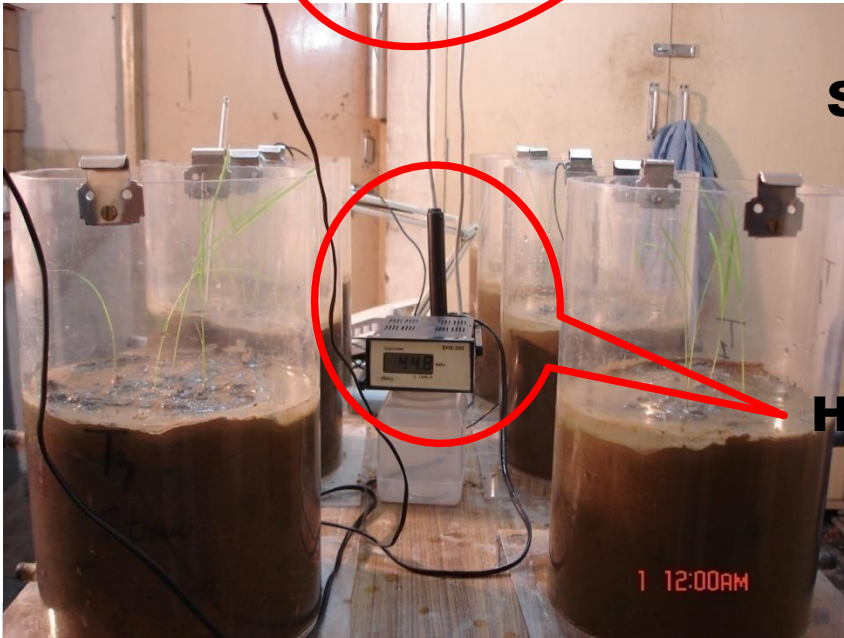
pH, Eh and Temp meter



Septums to collect soil solution



Hygrometer





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Thank you

