Background
Most of the world’s rice produced in Asia and mainly produced on flooded condition, which is the major source of anthropogenic greenhouse house gases (CH$_4$ and CO$_2$) emissions. Mid-season drainage has been reported as an irrigation strategy to minimize the GHG emission from flooded rice, but its implementation may be inconvenient for smallholder farmers due to lack of detailed control of water levels during the season. In contrast, early drainage is easy to control and implement, with no risk for the growing crop. Further, residue incorporation increases the soil C accumulation and mineralization of this C under the flooded conditions will cause higher background CH$_4$ and CO$_2$ emissions. We hypothesize that early drainage will be effective in mitigating the GHG emission from added organic material.

Questions
- Can early-season drainage be as effective as mid-season drainage in reducing emissions from labile C sources?
- Does background soil C enhance the GHG emission and can this be mitigated?
- Does the quality (stability) of organic substrates have an effect on GHG emission in relation to drainage time?

Results

### Methane

![Cumulative CH$_4$ Flux](chart.png)

**Fig. 5.** Total accumulated CH$_4$ emissions during rice production after 40 days of transplanting, following organic inputs and water pulses under different soil C pools. Values represent mean of three replications ± standard error.

- Early drainage highly reduced the CH$_4$ emissions from organic substrates.
- Background soil C showed significant effects in CH$_4$ emission after a short interval.

### Nitrous oxide

![Cumulative N$_2$O Flux](chart.png)

**Fig. 2.** N$_2$O flux during rice production within 40 days of transplanting, following organic inputs and water pulses under low background soil C. Values represent mean of three replications ± standard error.

- Early drainage resulted in higher N$_2$O emissions from all organic amendments.
- NH$_4$ mineralization effect of early drainage was only dominated in compost and straw treatment.

- Early drainage in combination with midseason drainage has a strong effect on CH$_4$ emissions reduction from flooded rice production.
- Background soil C has no effects on CH$_4$ and N$_2$O emissions in short period of time.
- Early drainage highly reduced the emission from labile C source (straw) by burning C in early season.

Conclusions

- Early drainage in combination with midseason drainage has a strong effect on CH$_4$ emissions reduction from flooded rice production.
- Background soil C has no effects on CH$_4$ and N$_2$O emissions in short period of time.
- Early drainage highly reduced the emission from labile C source (straw) by burning C in early season.