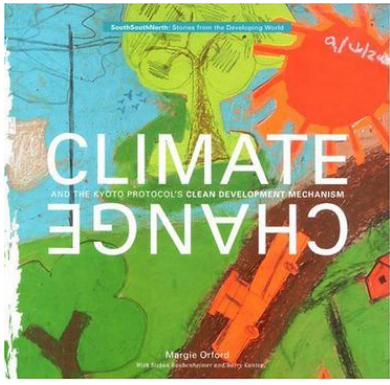
Institute of Environment and Sustainable Development in Agriculture,Chinese Academy of Agricultural Sciences

IEDA, CAAS

GLOBAL RESEARCH ALLIANCE ON AGRICULTURAL GREENHOUSE GASES



Mitigation of greenhouse gas emission from a double rice field of China

Xiaobo Qin, Yu'e Li, Yunfan Wan,
Jianling Li,Bin Wang

18 Sept 2015

In this talk

- **Stock-take**
- **Research updates**
- **Future work**

Stock-take

Project: Monitor and control of GHG emission reduction technologies from agricultural production system of China

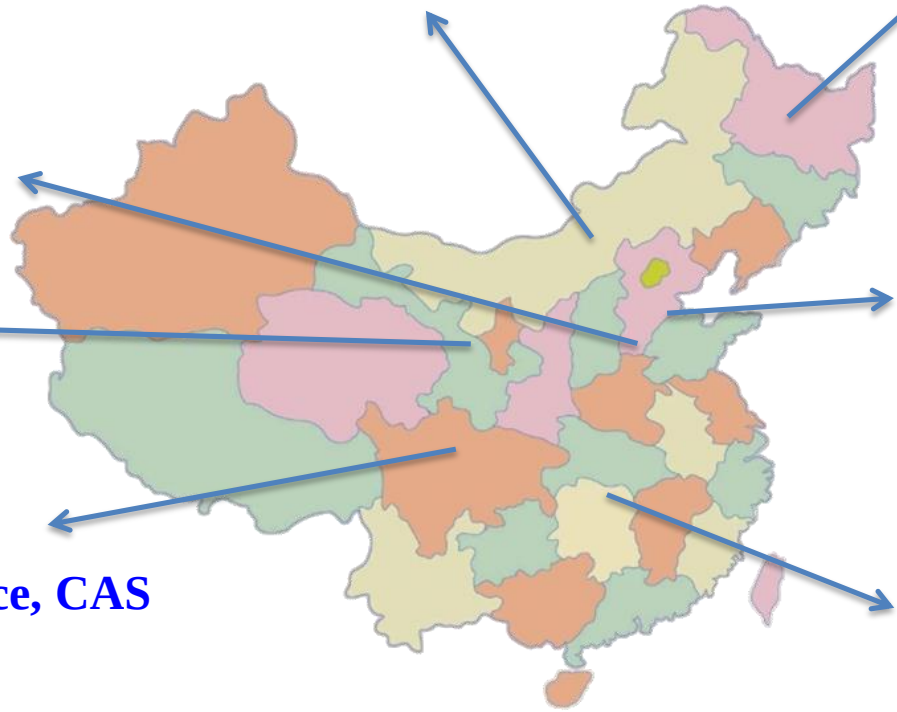
Period: 2011-2015

Fund: Non-profit Research Foundation for Agriculture (201103039), Ministry of Agriculture

Grass land
Institute of Atmospheric Physics, CAS

North East upland
Institute of applied ecology, CAS

Live stock
IEDA, CAAS



North West up land
China agricultural university

North China upland
Shandong Academy of agricultural sciences

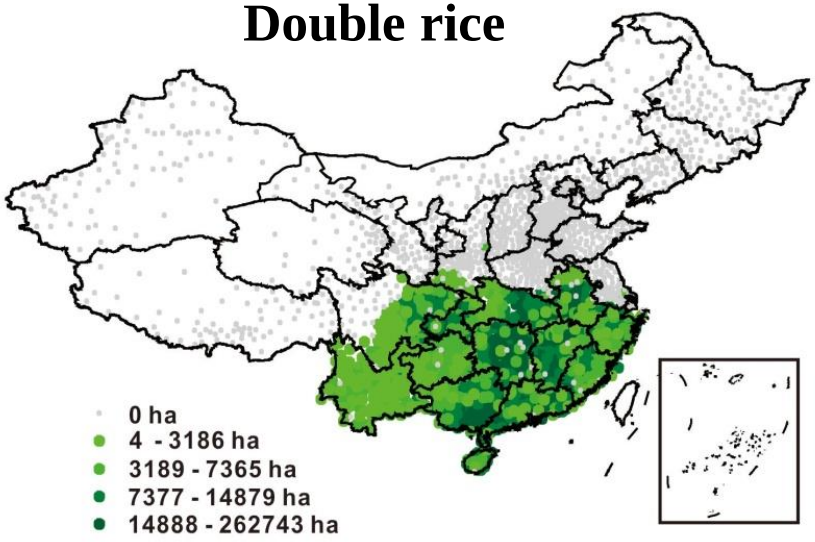
Single rice
Institute of Soil Science, CAS

Dobule rice
IEDA, CAAS

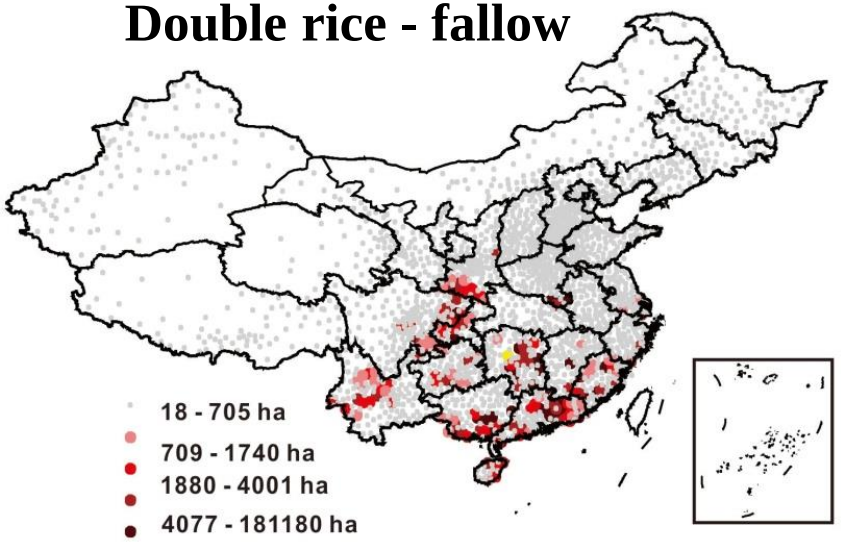
Project Host: Chinese academy of agricultural sciences, CAAS

Double rice production of China

Double rice

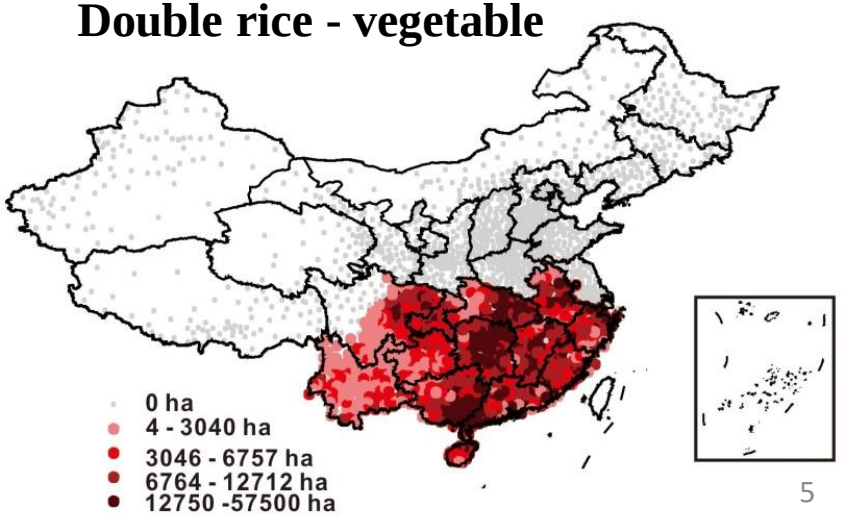


Double rice - fallow



Double rice - rape

Double rice - vegetable



Objectives

Monitor

GHG emission

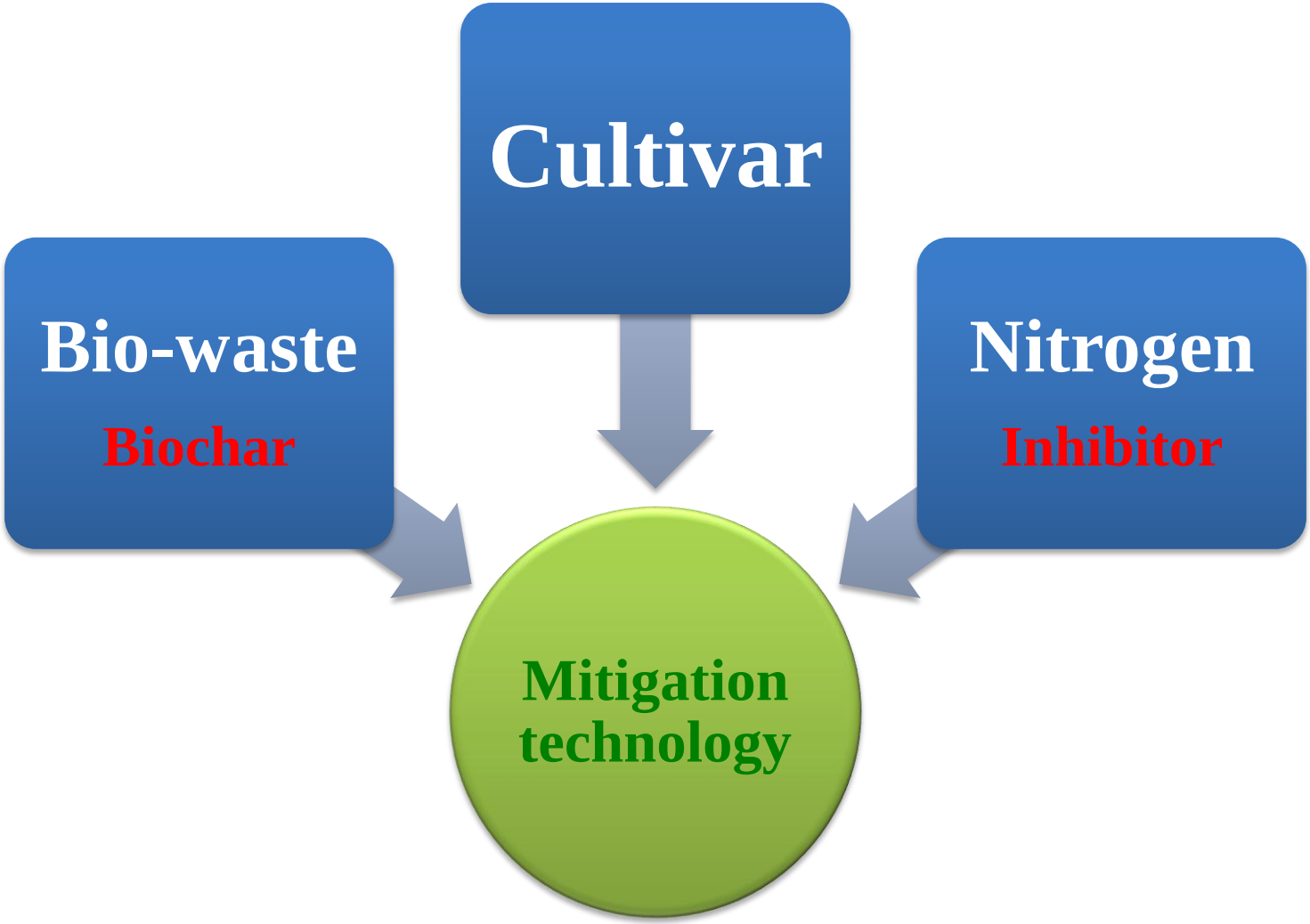
Screen

Practical mitigation technologies

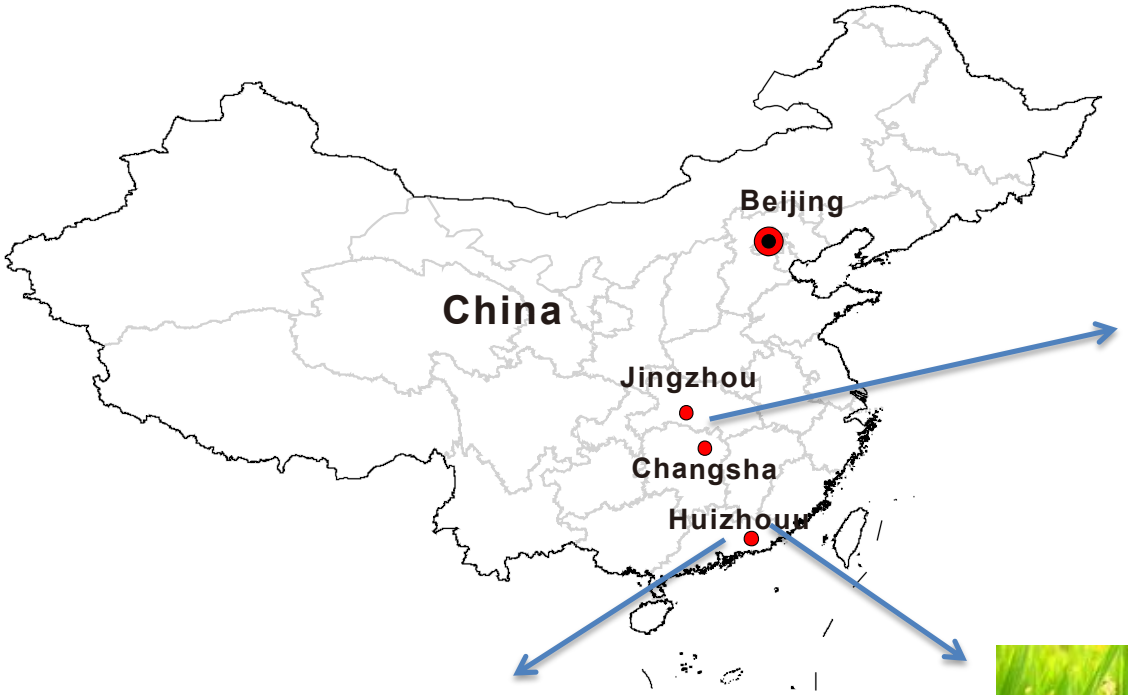
Demonstration

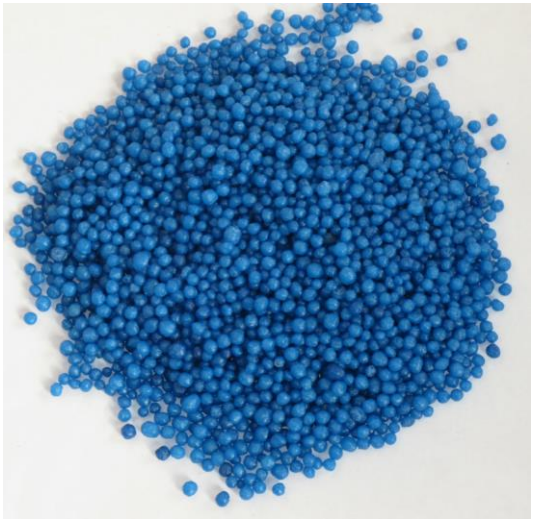
Localization

Mitigation choice



Field monitor





Application of the biochar

kg ha^{-1}

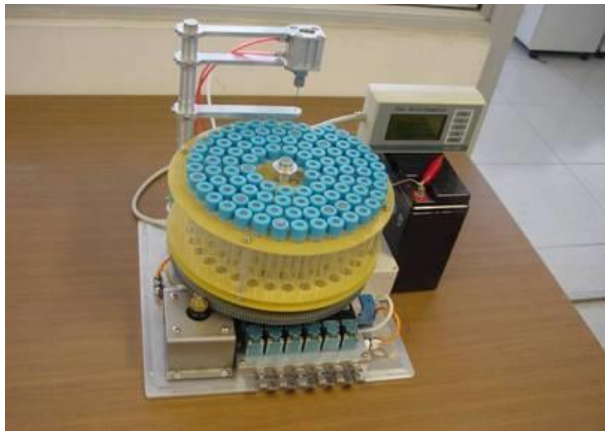
treatments	Base fertilization					Tillering fertilization	Jointing fertilization		Booting fertilization		
	N^b	P_2O_5	K_2O	Biochar	Straw	N (Urea)	N (Urea)	K_2O (KCL)	N^b	$P_2O_5{}^b$	K_2O^b
CK	72.00	135.00	72.00			34.50	55.20	45.00	36.00	36.00	36.00
BC1	72.00	135.00	72.00	5000		34.50	55.20	45.00	36.00	36.00	36.00
BC2	72.00	135.00	72.00	10000		34.50	55.20	45.00	36.00	36.00	36.00
BC3	72.00	135.00	72.00	20000		34.50	55.20	45.00	36.00	36.00	36.00
RS	72.00	132.36	72.00		2400	19.38	55.20	24.60	36.00	36.00	36.00
RI	72.00	132.36	72.00		2400	19.38	55.20	24.60	36.00	36.00	36.00

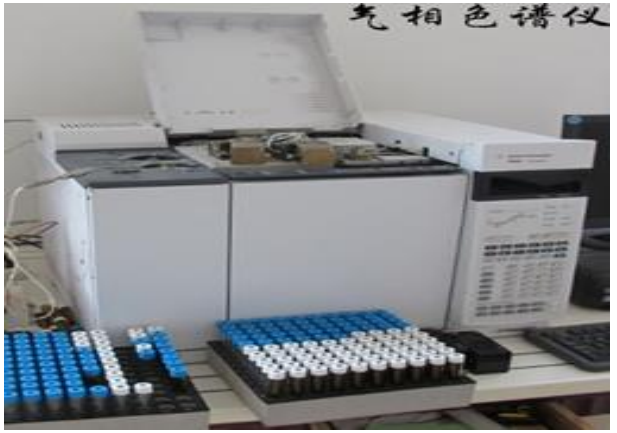
Characteristics of the rice cultivar

Cultivar	Growth days (d)	Optimum grain yield (kg ha^{-1})	Rice quality class		Eating quality score	Cold resistance	Rice blast resistance	Lodging resistance
			National standard	Provincial standard				
Hefengzhan	128-130	410.75	3	3	74	Medium	83.3-88.89%	Medium
Yuejingsimiao	111-114	405.37	2	2	81	Medium weak	98.55-100%	-
Qihuazhan	108-111	437.02	2	2	75-84	Medium	76.47-86.9%	Medium strong
Huangsizhan	129	437.86	1	1	90	Weak	63-63.77%	Medium
Huangruanzhan	132	435.54	-	3	76-81	Medium	95.5-100%	Medium
Yexianzhan 6	113	431.83	1	-	-	Strong	65%	Medium
Yexianzhan 8	110-117	435.69	3	-	-	Medium	53.5%	Strong
Huangxiuzhan	110-111	424.57	2	-	78-81	Medium	93.4%	Medium strong
Yueerzhan	127-130	461.70	2-3	-	-	Medium	41.9%	Weak

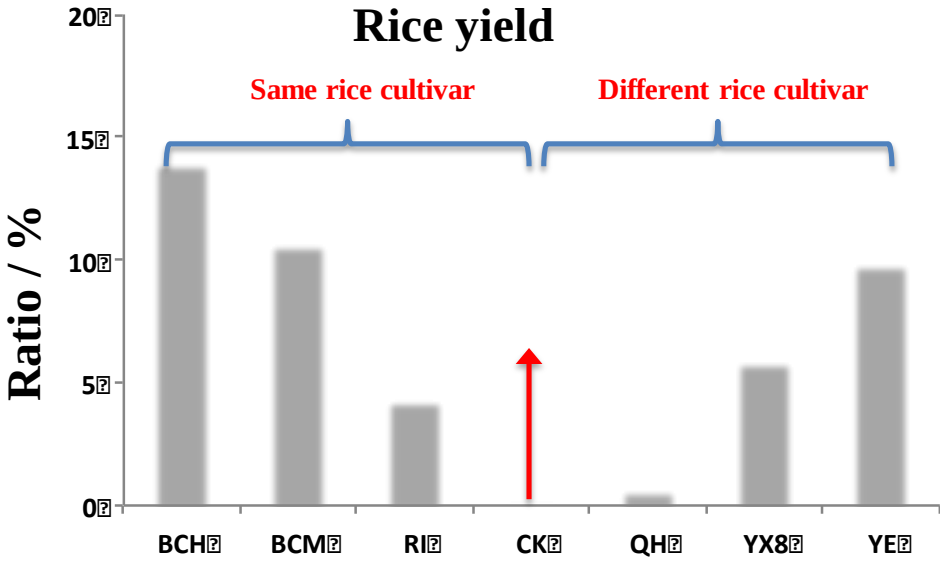
Modification of new N fertilizer

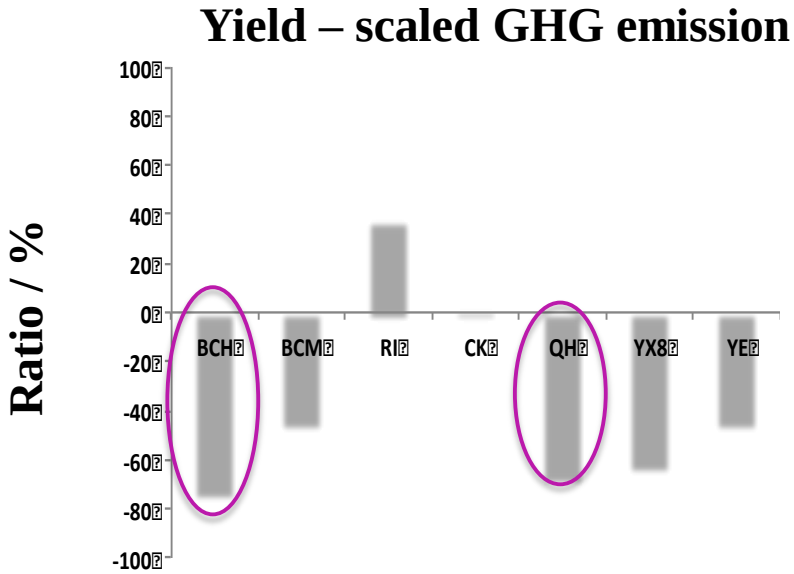
- Jingzhou agrometeorological experimental station, Hubei province, China(30° 21'N, 112° 09'E), from May 3rd, 2012 to April 28th, 2014
- An automatic sampling and monitoring system was used on each day during the rice growing season
- Manual sampling was undertaken at intervals of 10 days during the winter fallow period
- CH_4 and N_2O were analyzed by a gas chromatograph (Agilent 7890A)

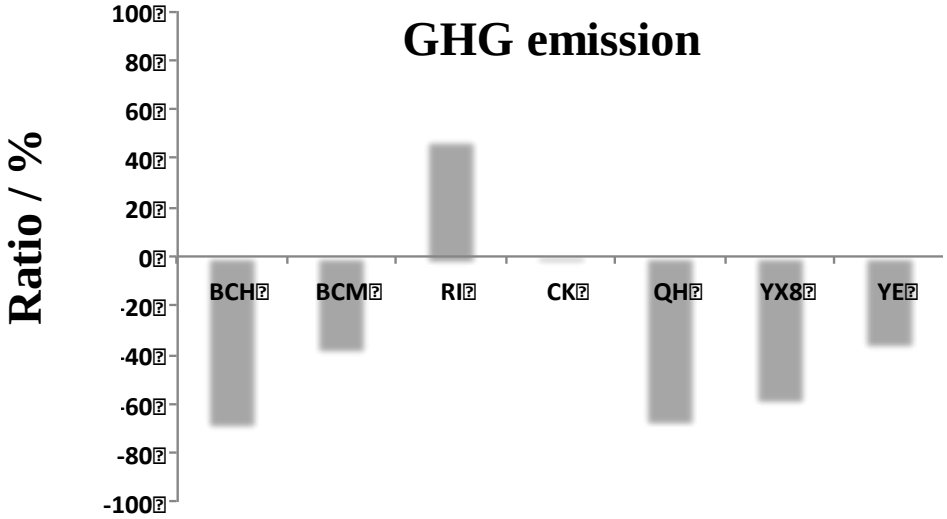




Technology screen



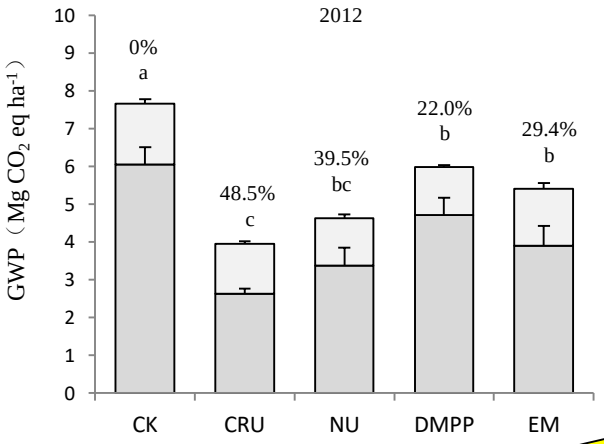


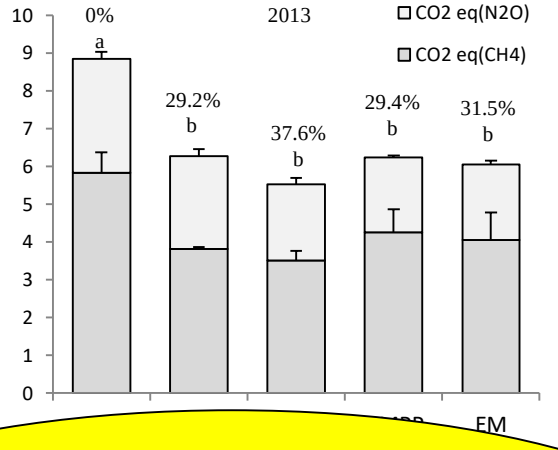


Biochar: 20t ha^{-1}
Cultivar: Qihuazhan, Yue'erzhan, Yexianzhan 8

Low GWP and High yield

(Qin et al., 2014, 2015)

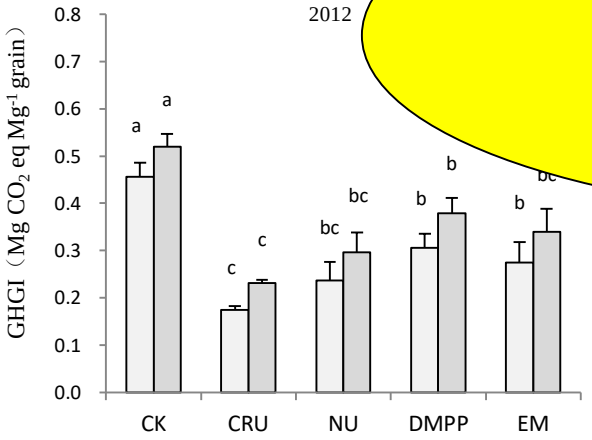


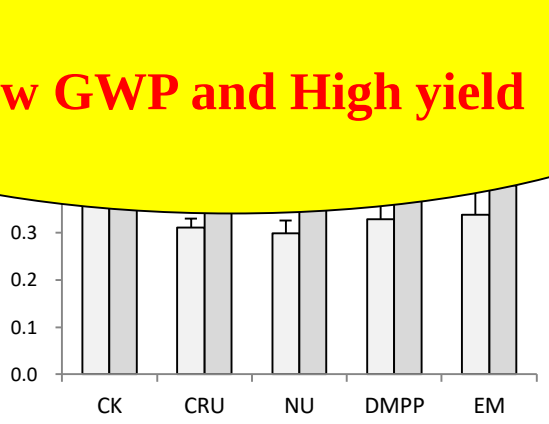


GWP of different treatments i

Modified N fertilizer

Low GWP and High yield





GHGI of different treatments in 2012 (left panel) and 2013 (right panel) rotations

Treat:

① CK Urea (N≥46%)

② CRU Polymer-coated controlled release urea (N≥42%, release period 90d)

③ NU N-Sever (N≥46%), a synthetic urea mixed with 5% nitrapyrin

④ DMPP Urea with 1% nitrification inhibitor 3,4-dimethylpyrazole phosphate

⑤ EM Urea with effective microorganisms

- Lower GWP and higher yield were observed with controlled release urea, nitrification inhibitor and effective microorganisms use.
- Polymer-coated urea reduced CH_4 emission significantly.
- Nitrification inhibitors reduced N_2O emission significantly.
- N_2O emissions and CH_4 consumptions were notable during fallow period.

(Wang et al., 2015, AEE)

Demonstration

Demonstration area: 4000 acre

Guangdong

Hubei

Priorities of research needs

Practicable mitigation option

Future work

N_2O emission from rice paddy

Ignore or not?

Uncertainty

Thank you for your attention!