Farmer's Adoption of Improved Nitrogen Management Strategies in Maize Production in Shandong of China: An Experimental Study

Xiangping Jia[1]
Jikun Huang[1]
Cheng Xiang[1]
Holger Bergmann[2]
Fusuo Zhang[3]

(1) Center for Chinese Agricultural Policy, Institute of Geographical Sciences and Natural Resource Research, Chinese Academy of Sciences
IGSNRR, Datun Road Jia No. 11, Anwai, Beijing, 100101
jiaxp.ccap@igsnrr.ac.cn

(2) Department of Agricultural Economics and Rural Development, Georg-August University, Göttingen, Germany

(3) China Agricultural University, Beijing, China

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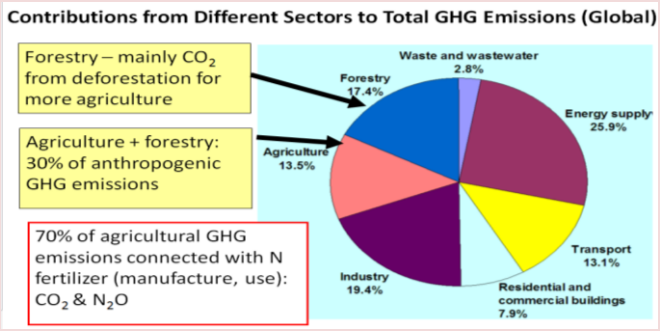
Introduction

While fertilizer use is an important way to increase crop yields, excessive usage of chemical fertilizer has resulted in serious environmental stress by increasing greenhouse gas emissions and polluting ground and lake water through nitrogen leaching (Izaurralde, et al., 2000).



Source: IPCC 4th Assessment Report (2007)

Scientists perceived the excessive use of nitrogen (N) fertilizer in China as inappropriate farming management. Ecomomists argued that farmer's lack of knowledge and information on crop response to N fertilizer are the primary reason for its overuse (Huang et al., 2008).

How improved nitrogen management can be adopted by China's small-scale farmers when the knowledge and information are delivered to them?

Objective

The overall goal of this paper is to examine impacts of improved nitrogen management (INM) training experiment on farmer's chemical nitrogen use behaviors in **maize** production in China.

Research Design and Data Collection

County: Huimin and Shouguang (in Shandong Province)

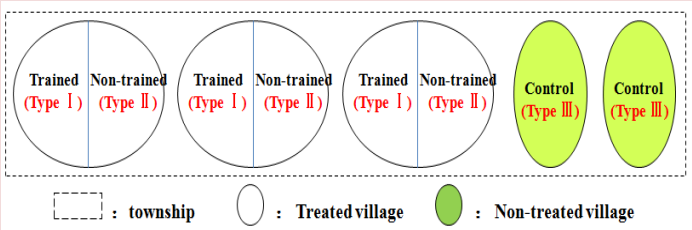
Township & Extension staff: In each county, 3 townships were randomly selected. One extension staff was selected from each local township extension station and trained by the soil scientists from China Agricultural University.

Villages: In each township, 5 villages were randomly selected
- 3 treated villages and 2 non-treated villages.

For each of the treated villages, a training course on INM in maize production was offered to farmers by the trained extension staff in May 2009 before maize was planted.

Farmers: 3 types - *trained farmers in treated villages* (Type I), *non-trained farmers in treated villages* (Type II), *farmers in non-treated villages* (Type III).

In each treated village, by asking whether the household participated in the training about improved nitrogen management, farmers of Type I and Type II are differentiated.

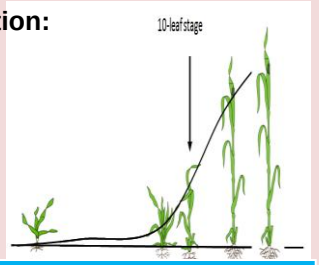


INM technology recommendation:

☆Reduce overall N use to 150-180 kg ha-1

☆Before 10-leaf stage: 50-60 kg ha-1

☆After 10-leaf stage: 100-120 kg ha-1



Results

	N fertilizer use[a] (kg ha^{-1})		
	Overall	Before 10-leaf	After 10-leaf
All households			
Trained farmers in treated villages	201	101	100
Non-trained farmers in treated villages	252**	122	130*
Farmers in non-treated villages	259**	132*	127
Huimin			
Trained farmers in treated villages	238	102	136
Non-trained farmers in treated villages	268	104	164
Farmers in non-treated villages	301**	108	193*
Shouguang			
Trained farmers in treated villages	179	99	80
Non-trained farmers in treated villages	221**	158**	63
Farmers in non-treated villages	217*	157**	60

◎Training indeed reduced farmer's overall N fertilizer use.

◎Training seems to be ineffective in balancing the N fertilizer use before and after the 10-leaf stage.

◎Farmer's N fertilizer use practices in maize production differ between SG and HM, which lead to different impacts of training on farmer's adoption.

Econometric Estimation: Tobit

$$N_{ij} = a_0 + a \cdot TFarm_i + b \cdot HM_i * TFarm_i + c \cdot NTFarm_i + d \cdot HM_i + \varphi \cdot X + \varepsilon_i$$

	N fertilizer use[b] (kg ha^{-1})		
	Overall	Before 10-leaf	After 10-leaf
Trained farmers in treated villages (Yes=1; No=0)	-49.19*** (3.15)	-43.60*** (3.91)	13.30 (1.16)
Trained farmers *HM County	7.72 (0.33)	46.89** (2.82)	-32.35* (1.94)
Non-trained farmers in treated villages (Yes=1; No=0)	-15.39* (1.76)	-0.54 (0.09)	-7.42 (1.20)
HM County dummy (Yes=1; No=0)	60.52*** (6.85)	-33.88*** (5.48)	85.70*** (12.84)
Household land area (ha)	-37.18*** (3.94)	0.49 (0.08)	-26.90*** (3.43)

☆Regression results show the effectiveness of the training in reducing the overall N fertilizer use in both SG and HM.

☆INM training only led to reduction of N fertilizer use before the 10-leaf stage in SG.

☆INM training led to significant reduction of N fertilizer use in HM rather than in SG after the 10-leaf stage

Conclusions

☆Through INM training in agricultural production, the environmental problems and economic loss related to the excessive nitrogen use in agriculture can be mitigated.

☆However, short-term training might not be enough for balancing N fertlizer use

☆The recommended technologies to maize farmers have to consider farmer's practices and local contexts.

☆Labor-saving fertilizer technology is critical to convince farmers to adopt INM technology and reduce N fertilizer use.