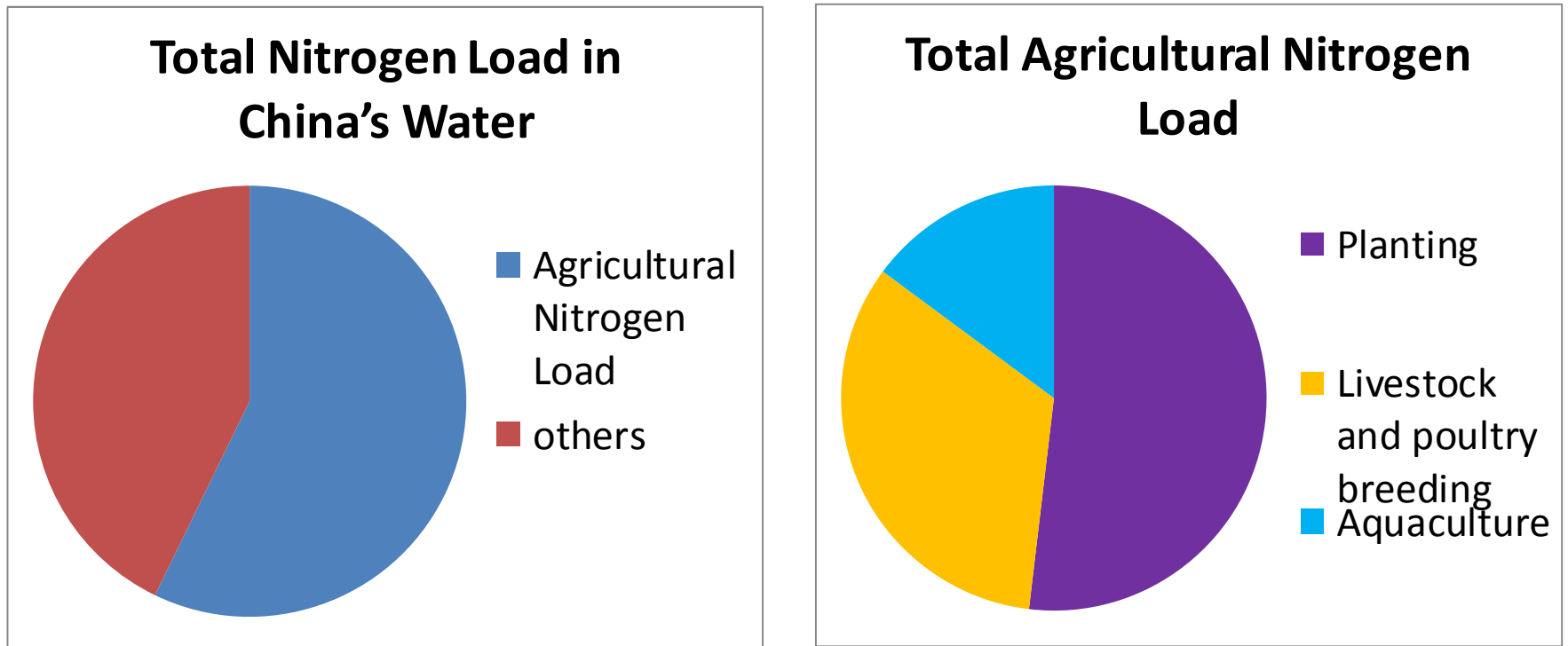# Agricultural Non-point Source Pollution Control Program in China: Analysis on Farmers' Participation Behavior

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Introduction

Total Nitrogen Load in China's Water

- Agricultural Nitrogen Load
- others

Total Agricultural Nitrogen Load

- Planting
- Livestock and poultry breeding
- Aquaculture

Source: the First Report of National Pollution Investigation in 2010 by Ministry of Environmental Protection, National Bureau of Statistics, and Ministry of Agriculture of the People's Republic of China

Structure

- Motivated by the China-UK program
- Provide an overview, and participation rates of the program
- Evaluate the key factors affecting farmers' participation in the program
- Propose suggestion to improve the participation rates

Literature Review

- Farmers' participation in extension program

- Satisfaction of the participants, confidence of the participants, provision of training (Salam et al., 2005; Jackson-Smith and McEvoy's, 2011).

- Age, education, income, land area (Fang and Kong,2005; Yu and Zhang, 2009; Li, 2011; Gao, 2011)

- Distance, access to information of training, awareness of the extension program, (Fang and Kong,2005; Chen et al, 2011; Gao, 2011)

Background of the China-UK Program

- Improving livelihoods on farms by reducing non-point N pollution through improved nutrient management
- Funded by the UK's Foreign and Commonwealth Office and by China's Ministry of Agriculture
- From January 2007 to December 2009
- Led by Dr. Tong Yanan from Northwest A&F University in China and Dr. David Powlson from Rothamsted Research in UK

Location of China-UK Program
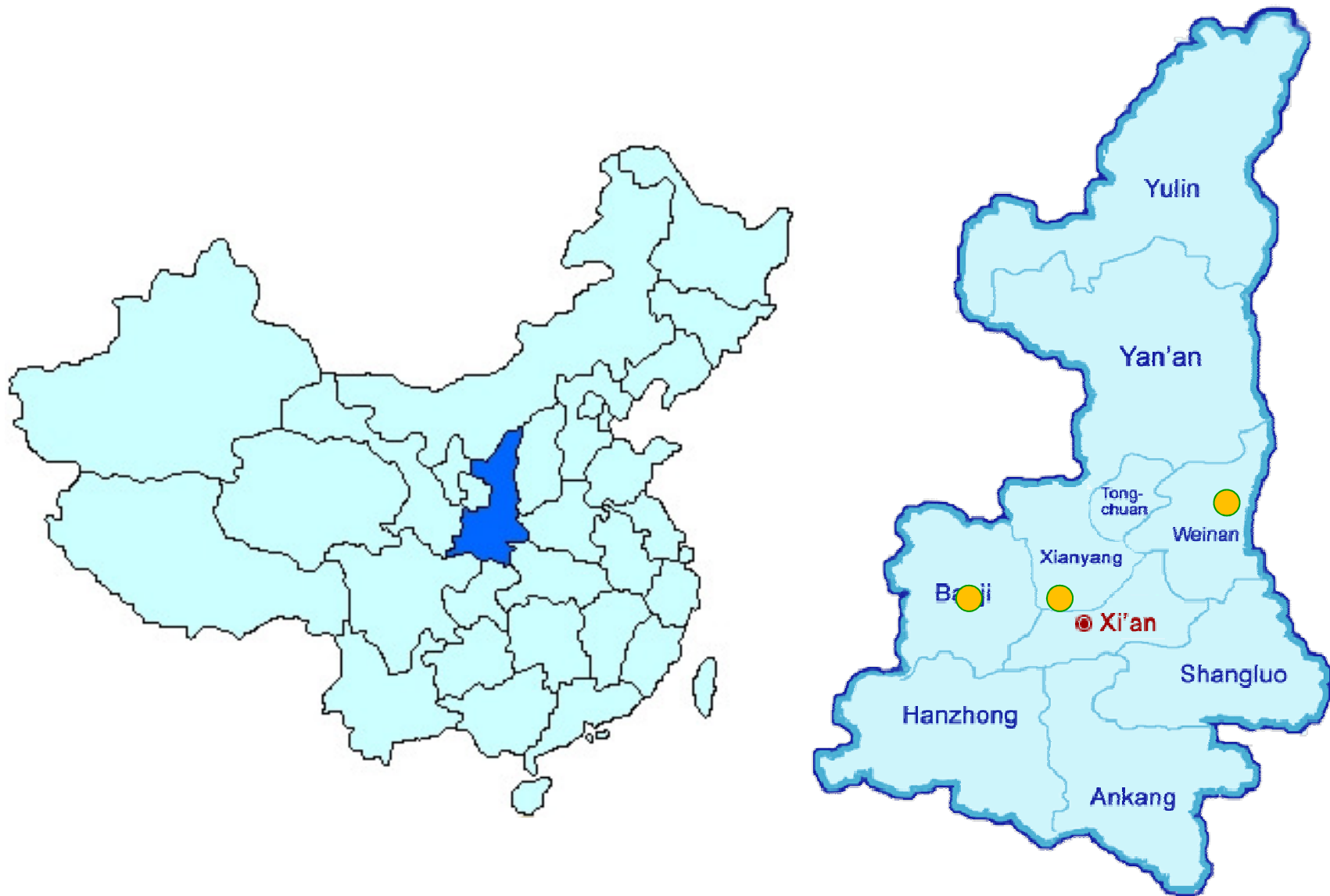
Objectives of the China-UK Program

- To provide information to poor farmers about rational fertilizer management
- To reduce fertilizer application rates
- To increase crop yields and economic returns

Components of the China-UK Program

1) Assessment of farmer and community perceptions

2) Collection and analysis of relevant data

3) Farm based experiments

4) Information delivery system

5) Analysis of Delivery System

Results of farm based experiments

	Village	Fertilizer input (before)	Fertilizer input (after)	Fertilizer changes	Usual yield	New Yield	Yield Changes
wheat	Village 1	194	123	-70	6754	6939	+185
	Village 2	197	179	-18	6437	6554	+117
	Village 3	140	118	-22	6422	6383	-39
	Total average	177	140	-36.7	6537.7	6625.3	+87.7
maize	Village 1	212	44	-167	5054	5262	+208
	Village 2	228	73	-155	4619	4918	+298
	Village 3	234	74	-160	5249	5510	+261
	Total average	224.67	63.67	-160.7	4974	5230	+255.7

Unit: kg/ha

Income changes of the farm based experiment

	Village	Fertilizer changes	Input cost changes	Yield Changes	Yield profit change	Total profit changes
Unit		Kg/ha	Yuan/ha	Kg/ha	Yuan/ha	Yuan/ha
wheat	Village 1	-70	-306	+185	+332	+639
	Village 2	-18	-79	+117	+221	+290
	Village 3	-22	-96	-39	-70	+26
	Total average	-36.7	-160.3	87.7	161	+318.3
maize	Village 1	-167	-728	+208	+312	+1040
	Village 2	-155	-674	+298	+447	+1121
	Village 3	-160	-694	+261	+392	+1086
	Total average	-160.7	-698.7	255.7	383.7	+1082.3

Information delivery system

- Farm Field School

Information delivery systems

- Demonstration zone & Farmers Viewing

Information delivery systems

- Farmer Meeting

Information delivery systems

- Farmer to farmer training

Information delivery systems

- poster, leaflet

Survey in this paper

- 331 face-to-face surveys
- May to July, 2011
- Nine villages
- Trained graduate students

Yulin

Yan'an

Tong-chuan

Weinan

Xianyang

Baoji

◉ Xi'an

Shangluo

Hanzhong

Ankang

Farmers' participation

components	Participation	
	number	percent
Farmer Field School	19	5.7%
Demonstration Zone	24	7.3%
Farmer Meeting	21	6.3%
Farmer to Farmer Training	30	9.1%
Poster and Leaflet	17	5.1%
None	263	79.5%

Farmers' participation

	participation	
	number	percent
0 component	263	79.5%
1 component	38	17.8%
2 components	22	12.7%
3 components	5	3.6%
4 components	1	1.5%
5 components	2	1.5%

Variables Description

Variables	Mean	Std. Dev
Personal Characteristics		
Gender (1=male, 0=female)	0.53	0.50
Age (actual age)	50.85	13.15
Education (1=high school or above, 0=others)	0.19	0.39
Farming Experience (years)	27.74	13.54

Variables Description

Variables	Mean	Std. Dev
Planting Characteristics		
Farming income ratio (%)	0.68	0.25
Farm labor ratio (%)	0.53	0.28
Area (1=less than 0.13ha; 2=0.14-0.26ha; 3= 0.27-0.4ha; 4=0.41-0.53ha; 5=0.54-0.67ha; 6=0.68 and above)	2.68	1.56
Using machine (1=yes,0=no)	0.90	0.29

Variables Description

Variables	Mean	Std. Dev
Awareness Of (1=yes,0=no)		
Agricultural NPS pollution	0.38	0.49
Environmental protection policies	0.44	0.50
Sustainable agriculture policies	0.27	0.44
Social capital (1=yes,0=no)		
Getting fertilizer information from friends or relatives	0.35	0.48
Farming methods affected by others	0.47	0.50

Variables Description

Variables	Mean	Std. Dev
Fertilizer Policies (1=yes,0=no)		
Awareness of training class	0.12	0.32
Experience of training classes	0.09	0.29
Support of laws to restrict the amount of fertilizer	0.80	0.40
Support of applying tax on the agricultural NPS pollution	0.63	0.48

Probit Results

Varables	Coefficient	Marginal Effects
(constant)	-4.407**	---
Gender	-0.524*	-11.46%
Education	0.736**	19.69%
Farming income ratio	1.111*	6.7%
Awareness of sustainable agriculture	0.629*	15.49%
Getting fertilizer information from friends or relatives	-0.593**	-11.64%
Awareness of training class	0.987*	29.76%
Experience of training classes for fertilizer using.	1.195**	38.11%
Support the law to restrict the amount of fertilizer.	0.849**	13.64%

Conclusion

- Key factors affecting farmer participation:
  - Education
  - Training experiences

- Future research:
  - Evaluate the China-UK program's effects (matching)
  - Which components are most effective in delivering information about rational fertilizer management.

Thank you!