Agricultural Technology Intervention, Health Information and Pesticide Use among Farmers: Evidence from China

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Introduction

- While pesticide use greatly increase agricultural yield, farmers in China have been often accused of ***overusing pesticides*** in crop production.
- In China, pesticide overuse may be due to farmers' lack of knowledge in terms of crop protection, which may be further attributed to ***poor public agricultural extension services***.
- Poor medical facilities in rural China provide ***poor health information*** to farmers, which may lead them to be over-optimistic about their health status and continue to intensively use pesticides in crop production.
- In the context of ***current agricultural extension system***, could conventional agricultural technology or health information ***interventions*** contribute to pesticide reduction in China?

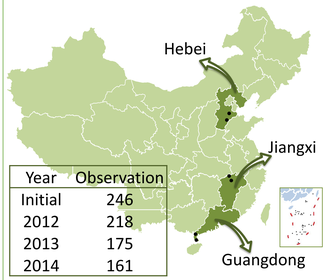
Objectives

The objectives are as follows:

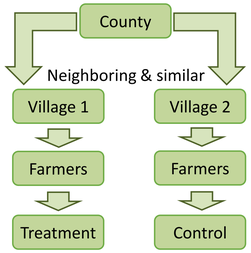
- To determine the effect of conventional agricultural technology intervention on pesticide use;
- To determine the effect of health information intervention on pesticide use;
- To identify the other factors influencing pesticide use.

Agricultural Technology Intervention: Experimental Design

- Research duration: March 2012 to December 2014
- Intervention duration: January 2013 to December 2014
- Locations: Guangdong, Jiangxi and Hebei



Year	Observation
Initial	246
2012	218
2013	175
2014	161



Data and Model

- **Health examination and health information feedback**
  - Blood complete counts
  - Blood chemistry panel
  - Conventional nerve conduction studies

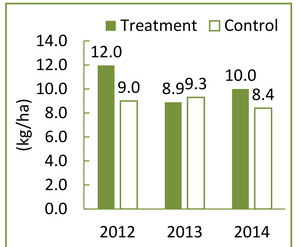
Health examinations

- **Household survey and data collection**
  - Annual household survey: ***characteristics and other variables***
  - Longitudinal survey: ***record of pesticide use***
    - Training session on how to make desired records
    - Semimonthly or monthly checks
- **Difference-in-differences modeling**
  - The difference-in-differences (DD) model is developed as follows:

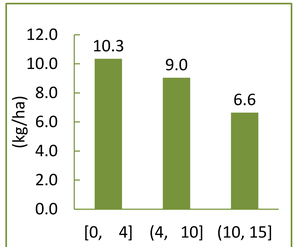
$$Q_{it} = \alpha_0 + \alpha_1 T_i + \alpha_2 Y_t + \alpha_3 (T_i \times Y_t) + \alpha_4 HI_{it} + \alpha_5 Z_{it} + \delta_i + u_{it}$$

  - Q: the amount of pesticide use per hectare
  - T: a dummy variable for treatment (e.g., technology intervention)
  - Y: a dummy variable for year after treatment
  - HI: the number of abnormal health indicators
  - Z: a group of other control variables
    - Individual characteristics: male, age, education, cadre
    - Household characteristics: labors endowment, cropping structure
    - Risk perception: pests occurring in the preceding year
    - Other variables: villages, and planting season
  - δ: the time-invariant effect
  - u: the random error term

Results



Pesticide use before and after technology intervention



No. of abnormal health indicators and pesticide use

Estimation results of difference-in-differences model: overall

Variable	Pooled OLS		Fixed effect		Random effect	
	Coef.	t-stat	Coef.	t-stat	Coef.	t-stat
Constant	-2.55	-0.55	-108.55*	-1.92	-2.76	-0.60
2013	2.54	1.29	1.32	0.70	2.57	1.33
2014	3.47**	2.28			3.51**	2.27
Treatment	11.36***	2.80			8.69***	3.29
Treatment×2013	-4.25	-1.51	-3.05	-1.07	-4.11	-1.46
Treatment×2014	-2.97	-1.12	-2.17	-0.69	-2.89	-1.07
No. of abnormal HI	-0.41*	-1.73	-1.17**	-2.32	-0.46*	-1.89
Age (years)	0.22***	2.63	2.35**	2.13	0.22***	2.69
Cadre (yes=1)	-2.61*	-1.95			-2.64*	-1.91
% of off-farm labors	-0.08***	-3.04	-0.10***	-4.00	-0.08***	-3.19
Cotton (yes=1)	8.70***	3.83	8.62***	3.81	8.76***	3.94
Grain (yes=1)	-6.43***	-2.94	-5.02*	-1.94	-6.31***	-2.93
Village effect	Yes		Yes		Yes	
Observation	554		554		554	
Adjusted R^2	0.13		0.09			

Note: *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively. ***HI*** denotes health indicators. Other control variables are included but not reported. The amount of pesticide use is measured by kg/ha.

Robustness Checks

Estimation results of difference-in-differences model: by crop

Variable	Pooled OLS		Fixed effect		Random effect	
	Coef.	t-stat	Coef.	t-stat	Coef.	t-stat
Overall Balanced panel (Obs.: 420)						
Treatment×2013	-1.31	-0.40	-1.81	-0.55	-1.38	-0.42
Treatment×2014	-2.10	-0.64	-2.35	-0.69	-2.14	-0.65
No. of abnormal HI	-0.32	-1.10	-1.04*	-1.90	-0.41	-1.33
% of off-farm labors	-0.09***	-2.82	-0.11***	-3.87	-0.09***	-3.06
Cotton (Obs.: 199)						
Treatment×2013	-2.22	-0.46	-2.56	-0.50	-2.95	-0.64
Treatment×2014	-8.22	-0.83	-10.61	-0.99	-9.36	-0.93
No. of abnormal HI	-1.75**	-2.47	-0.55	-0.58	-1.73***	-2.65
% of off-farm labors	-0.13*	-1.94	-0.14	-1.22	-0.13*	-1.75
% of major pests	0.41***	3.23	0.78***	3.37	0.48***	3.64
Rice (Obs.: 278)						
Treatment×2013	-2.07	-1.00	-1.21	-0.53	-1.98	-0.95
Treatment×2014	-0.03	-0.02	-1.00	-0.52	-0.14	-0.08
No. of abnormal HI	-0.44**	-2.21	-0.57	-2.00	-0.44**	-2.25
% of off-farm labors	-0.03**	-2.00	-0.06***	-2.66	-0.03**	-2.08
% of major pests	0.08***	2.70	0.13**	2.31	0.08***	2.82
Maize (Obs.: 274)						
Treatment×2013	-0.12	-0.10	0.25	0.19	-0.12	-0.10
Treatment×2014	1.16	0.89	2.62*	1.92	1.16	0.89
No. of abnormal HI	-0.21**	-2.33	-0.35	-1.64	-0.21**	-2.33
% of off-farm labors	-0.02*	-1.76	-0.03**	-2.04	-0.02*	-1.76
% of major pests	-0.00	-0.10	0.02	0.86	-0.00	-0.10

Note: *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively. ***HI*** denotes health indicators. Other control variables are included but not reported. The amount of pesticide use is measured by kg/ha.

Discussion and Conclusions

- Conventional agricultural technology intervention in the context of current agricultural extension system may be ineffective in leading farmers in China to use less pesticide.
- Health information feedback significantly affects farmers' pesticide use, but the probability of heterogeneity should be further investigated.
- Individual and household characteristics, and risk perception may also affect farmers' pesticide use.

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