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Effects of inclusive public agricultural extension service: Results from a policy reform experiment in western China ☆

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ABSTRACT

The top–down public agricultural extension system in China and its early commercialization reforms during the 1990s have left millions of farmers without access to extension services. A pilot inclusive agricultural extension system was introduced in 2005 to better meet the diverse needs of small-scale farmers. Three key features of the experiment are (1) inclusion of all farmers as target beneficiaries, (2) effective identification of farmers' extension service needs, and (3) an accountability system to provide better agricultural extension services to farmers. This paper describes design of the reform initiative and examines its effect on farmers' access to extension services. Based on farmer supplied data from six counties for the years 2005 to 2007, this paper shows that inclusive reform initiatives significantly improve farmers' access to and actually received of agricultural extension services as well as their adoption of new technologies. Implications for further reforms to the agricultural extension system are also discussed.

1. Introduction

Many countries established their agricultural extension systems in order to realize their national food security goals (Hu, Yang, Kelly, & Huang, 2009; Swanson, 2006; Umali & Schwartz, 1994, 1997). Through the combined efforts of international organizations and national governments, by the 1980s most Asian developing countries and some on other continents had successfully improved their food security (Swanson, 2006). As a result, government support for public research and extension in most countries began to fall in the late 1980s (Huang, Hu, & Rozelle, 2003; Huang, Hu, Zhang, & Rozelle, 2000; Swanson, 2006).

Budget problems have forced many countries to reform their public agricultural extension system (Feder, Willett, & Zijp, 1999; Umali & Schwartz, 1994). While in Europe these reforms took the form of privatization, in some developing countries they involved decentralization and commercialization (Anderson & Feder, 2003; Hu et al., 2009; Rivera, Qamar, & Crowder, 2001; Umali & Schwartz, 1994, 1997). Previous studies showed that privatization reform had resulted in reduced farmers' access to public agricultural extension services (Cary, 1998; Feder et al., 1999; Lindner, 1993; Umali & Schwartz, 1994, 1997). Klerkx and Leeuwis (2008) argued that, due to market and systemic failures, both buyers and sellers experienced constraints in effecting transactions and establishing the necessary relationships to engage in demand-driven innovation processes.

Market reform and globalization have prompted small-scale farmers to change their traditional production structure, which often requires a more diversified extension service (Klerkx & Leeuwis, 2008; Rivera et al., 2001). High-value agricultural

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production and off-farm jobs have become major opportunities for farmers to escape rural poverty. This change has made the traditional institutional arrangement of public extension less effective in delivering services to farmers. Because the institutional goal of a public agricultural extension system is to realize the nation's food security, services to farmers engaged in high-value agricultural production are not a priority in many developing countries. Consequently, the traditional agricultural extension system is not always set up in such a way as to support farmers' demands for diversified services.

China is an interesting case in the evolution of agricultural extension reform. While its top–down public agricultural extension system played a significant role in promoting technological progress and agricultural output growth in China in the 1970s and 1980s (Fan, 2000; Huang & Rozelle, 1996; MOA 1999; Zhu, 1995), the system has faced great challenges after the late 1980s when China accelerated its reform process from the planned to a market oriented economy (Huang et al., 2000). As in other developing countries (Feder et al., 1999; Kidd, Lamers, Ficarelli, & Horrmann, 2000; Umali & Schwartz, 1994, 1997), China's government has conducted a series of agricultural extension reforms since the mid-1980s. In 1985, the government encouraged the public agricultural extension station to earn their own income through commercial activities to make up the budget shortage (Wang, 1994). While this reform did raise budget to overcome budget constraint, the commercialization reforms had also pushed public extension agents to sell more pesticides and fertilizers to farmers (Huang, Qiao, Zhang, & Rozelle, 2001). Budget constraint and moving to a more market oriented economy had also induced the decentralization reform for China's township[1] agricultural extension station in the early 1990. The reform passed the township agricultural extension station management and core funding from county's agricultural bureau to township government. Previous studies found that this reform resulted in the extension technician spending too much time on administrative affairs other than extension because township government's mandates are overall economic growth and social stability (Hu, Huang, & Li, 2004; Hu et al., 2009; Ke, 2005). A survey found that more than 80% of farmers did not see any extension technician in the villages during the period of 1996 to 2002 (Cai & Hu, 2009; Hu et al., 2004). Even for the limited actual agricultural extension work, technicians largely focused on the grain sector and on designated demonstration farmers, which hardly met farmers' demand for diversified extension services (Hu et al., 2007).

In response to the mixed results of early reforms, China has started a number of new initiatives to promote a more demand-driven public agricultural extension system. In 2005, an inclusive public agricultural technology extension system was introduced as a pilot in Pengzhou city (a county-level city), Sichuan province; and Wuchuan county, Inner Mongolia Autonomous Region (IMAR). The goal of pilots is to make the public agricultural extension technicians go down to farmer's fields to provide extension services to meet the diverse technology and marketing information needs of small farmers at the village level (Chen & Shi, 2008; Hu, Li, Zhang, & Shi, 2006). Following initial successes, the reform model was embraced by both local and central governments, modified and scaled up in 2006 and 2007. The objectives of this paper are to describe the design of the inclusive reform initiative in 2005 and its scaled-up initiatives in 2006–2007 and to examine their effects on farmers.

2. The design of inclusive village-level public agricultural extension service

The pilot inclusive agricultural extension system (called INC initiative later) was introduced in 2005 to better meet the diverse needs of small-scale farmers. Three key features of the experiment are: (1) inclusion of all farmers as target beneficiaries; (2) effective identification of farmers' extension service needs; and (3) an accountability system to provide better agricultural extension services to farmers. The pilot was then scaled up by the county (called Penzhou initiative later) and central governments [called the Ministry of Agriculture (MOA) initiative later] in 2006 and 2007 with some modifications to the pilot. The basic design and features of the original pilot initiative and its modified initiatives are discussed below and also summarized in Table 1.

2.1. Design and implementation of inclusive extension policy

The Center for Chinese Agricultural Policy of the Chinese Academy of Sciences; the National Agricultural Technology Extension Service Center of the Ministry of Agriculture; and China–Canada Small Farmers Adapting to Global Markets Project designed and implemented a pilot inclusive public agricultural extension service reform program (called the INC initiative). The program randomly selected technicians from township extension stations to participate in the reform. The selected technicians (responsible agents or RAs) were required to provide extension services to farmers in certain randomly selected villages for which they were responsible (responsible villages or RVs) any time the farmers called them. Each RA's responsibility covered a wide range of agricultural extension services, including plant protection; fertilizer use; technology related to seed, irrigation, machinery, and farm management; marketing information; and so on.

The INC initiative reform programs were initially introduced in Pengzhou and Wuchuan in 2005. Five technicians at the township-level were randomly selected as the RAs and 5 villages were randomly selected as pilot RV sites in each county. An additional 5 villages were randomly selected and added to the program in 2006, and 5 more villages were randomly selected and added in 2007. By 2007, then, 15 villages in each county were participating. As a result, each technician (RA) was responsible for 3 villages (RVs) by 2007.

To make RAs to take a more proactive role in meeting the diverse agricultural extension needs of small-scale farmers, the INC initiative adopted various approaches to identify farmers' extension service needs. The Rapid Rural Assessment (RRA) approach is

[1] The hierarchy of administrative under province in China is prefecture, county, township and administrative village (or village).

Table 1
INC and other initiatives to reform the Chinese agricultural extension system at the village level, 2005–2007.

	INC reform initiative	Pengzhou government reform initiative	MOA reform initiative – Calaqin	MOA reform initiative – Pixian
Location	Pengzhou, Sichuan; Wuchuan, IMAR	Pengzhou, Sichuan	Kalaqin, IMAR	Pixian, Sichuan
Started year	2005	2006	2007	2006
Target groups	All farmers in the village	Demo farmers in the village	Demo farmers in the village	Specialized and demo farmers
Target commodities	All crops and livestock	All crops and livestock	Major crops	Major crops
Services	All services related to crop and livestock activities	Technical services related to crop and livestock production	Technical services related to special crops	Technical services related to special crops
Identification of farmers' needs	Design appraisal form for identifying farmers' extension needs	Select farmers for interview by extension agent (not random)	Team of county-level extension staff designs questionnaire	Team of county-level extension staff designs questionnaire
	Randomly select farmers to attend the focus group	Identify technique problems of those selected farmers	Individual farmers complete the questionnaire	Individual farmers complete the questionnaire
	Hold discussion among the experts to identify the farmers' technique problems		County-level extension bureau assesses farmers' technique needs	County-level extension bureau assesses farmers' technique needs
	Compile information on farmers' technique needs			
	Hold technique training with farmers to confirm farmers' technique needs			
Accountability system for extension agent	Individually based	Individually based	Station-based	Station-based
	Responsible for extension at three villages	Responsible for extension in three villages	Township extension agent provides door-to-door services to demo farmers	Township extension agent provides door-to-door services to demo farmers
	Participate in the needs assessment for farmers	Participate in the needs assessment for farmers	Team of extension experts from the county-level extension bureau provides services during the busy season	
	Provide effective services to meet farmers' needs	Provide effective services to meet farmers' needs		
	Ensure farmers' access all the time (24-hour telephone access)	Ensure farmers' access all the time (24-hour telephone access)		
	On-call services for emergent problems	On-call services for emergent problems		
Monitoring and evaluation	Year-end performance assessment by project leader and local government	Year-end performance assessment by local government	Year-end performance evaluation of township extension station by the county agriculture bureau, township government, and clients (including the demo farmers) with relative weights of 50%, 30%, and 20%	Year-end performance evaluation of township extension station by the county agriculture bureau and township government with relative weights of 70% and 30%
	Percentage of farmers visited in the responsible villages based on a survey of randomly selected farmers	Percentage of farmers visited in the responsible villages	Year-end performance evaluation of individual township extension agents by the county agriculture bureau, township government, and clients (including the demo farmers) with relative weights of 40%, 30%, and 30%	Year-end performance evaluation of individual township extension agents by the county agriculture bureau, township government, and clients (including the demo farmers) with relative weights of 60%, 10%, and 30%
	Number and types of technique services provided based on a survey of randomly selected farmers	Number and types of technique services provided	Qualitative performance indicators	Qualitative performance indicators
	Responsiveness for emergent issues	Responsiveness for emergent issues		

Table 1 (*continued*)

	INC reform initiative	Pengzhou government reform initiative	MOA reform initiative – Calaqin	MOA reform initiative – Pixian
Monitoring and evaluation	Number of technique problems solved	Number of technique problems solved		
	Number of demo farmers	Number of demo farmers		
	Number of calls made to the monitors	Number of calls made to the monitors		
Incentive mechanism	Subsidies for travel and telephone expenses for providing advisory service	Subsidies for travel and telephone expenses for providing advisory service	Performance evaluation linked to promotions of individual extension agents	CNY 5000 operational fund per extension worker
	Year-end bonus in range of CNY 0–4000	Year-end bonus in range of CNY 0–3000	Extension agents permitted to earn extra income by selling agricultural inputs	30% more transportation subsidy than the county agriculture bureau provides
				Performance evaluation linked to promotions of individual extension agents

Source: Authors' own survey.

a participatory method used to identify farmers' technology needs (Hu et al., 2007). During an RRA workshop in the RV, 20 randomly selected farm families completed a workbook that tracked their production practice problems, technology needs, and challenges. Another 20 randomly selected individual farmers in each RV completed a survey of their agricultural production activities. Based on the results from the RRA workshop and the survey, the farmers' technology problems and needs for agricultural extension services were identified. The RAs for each RV constructed a plan for solving these identified problems and providing necessary services to the farmers. This plan was also one of the basic indicators for assessing each RA's performance at the end of each year.

To ensure that the RAs worked toward meeting the farmers' diversified needs for extension services, the INC initiative included an accountability system. First, the RAs were required to provide services to all farmers in their respective RVs. The contact information of the RA was displayed on a banner in the village. Second, the INC initiative included a monitoring and evaluation component. The RA's performance was assessed by an evaluation team that consisted of the pilot project leader and local government officials. The key performance indicators were the RA's door-to-door services for all farmers in his or her RVs, summed up as the "3A indicators": availability, whether the farmers in the RV saw the RA in the past year; Actually received, whether the farmers in the RV actually received service from the RA in the past year; and Actually Adopted (or Adoption), whether the farmers in the RV adopted the services provided by the RA in the past year. In accordance with this assessment, each RA was eligible to receive a bonus of up to CNY 4000 a year.

At the end of each year, a team made up of project members and local officials evaluated each RA. The team interviewed 10 randomly selected farmers in each RV and used the 3A indicators to assess the RA's performance. Based on the survey results and other records, such as farmers' feedback, the evaluation team determined each RA's bonus. After its successful implementation of the INC reform initiative in the two pilot counties, the Pengzhou government and the Ministry of Agriculture (MOA) initiated similar reform programs with a few modifications as described below.

2.2. Pengzhou government reform initiative

Based on the pilot INC initiative, the Pengzhou initiative was introduced in 2006 by the city government (called Pengzhou initiative). The initiative covered 22 villages in two township in 2006 (villages not involved in the INC pilot program) and then expanded to 130 villages, with 65 township agricultural extension technicians participating, in 2007. Each technician was responsible for 2 villages. However, the extension agents were responsible for identifying the farmers' needs based on their own individual informal survey, rather than through RRA as under the INC initiative. Although the agents were also required to provide public agricultural extension services to all farmers in the RVs, the target group was farmers selected for technology demonstration purposes. The maximum year-end bonus was CNY 3000, as opposed to the CNY 4000 in the INC initiative.

2.3. MOA Pixian and Kalaqin programs

MOA introduced a similar policy initiative to 25 counties from 25 provinces in 2006 and 31 counties from 31 provinces in 2007. By 2009, more than 300 counties had implemented the reform. This study selected two MOA reform pilot sites, Pixian county in Sichuan province and Kalaqin Qi (a county-level city) in IMAR, to study the impacts of the reform. For these two counties, Pixian implemented the reform program in 2006 and Kalaqin implemented in 2007. Unlike the INC initiative and the

Table 2
Characteristics of the sample villages by reform initiative in 2007.

Type of reform initiative	Number of sample villages	Population per village	Average number of households per village	Arable land per village (hectares)	Average arable land per household (hectares)
INC reform initiative and control, non-reform comparison villages					
Wuchuan, IMAR					
INC initiative (reform villages)	15	1722	431	1119	2.54
Non-reform (control villages)	15	1597	435	1075	2.46
Pengzhou, Sichuan					
INC initiative (reform villages)	15	1978	653	110	0.17
Non-reform (control villages)	15	2637	830	132	0.16
Pengzhou government initiative, MOA reform, and control, non-reform comparison villages					
Pengzhou, Sichuan: Pengzhou initiative	15	2077	654	117	0.17
MOA reform initiative					
Reform county: Kalaqin, IMAR	15	2289	584	237	0.38
Control, non-reform county: Songshan, IMAR	15	3350	861	789	1.19
Reform county: Pixian, Sichuan	15	2419	765	170	0.22
Control, non-reform county: Doujiangyan, Sichuan	15	2136	654	200	0.41

Source: Authors' survey.

Pengzhou initiative, MOA's reform program covered all extension staff and all villages in the county. Both Kalaqin and Pixian used service contracts with the extension agents and provided public agricultural extension services to the selected farmers.

The MOA reform differed from the INC initiative in several ways. First, an attempt was made to include the county-level extension agents in the reform initiative. Separate service contracts were designed for the county- and township-level extension agents with the MOA initiative.[2] They were required to work together to provide door-to-door technology services to pilot villages. Second, farmers' technology needs were identified through a questionnaire rather than the RRA method. The results of the questionnaire were incorporated into the services provided by the agents. Third, while the MOA reform also provided services to all farmers, the target group was the model farmers selected for technology demonstration purposes. Fourth, local government provided extra operational funds to encourage agricultural extension agents to go to the villages. In Pixian, for example, an operational fund in the amount of CNY 5000 per year was provided for each responsible agent. Fifth, extension agents were assessed jointly by their work units and the selected farmers. The performance assessment was linked to agents' promotion.

3. Sampling, data collection, and description

In order to examine the effects of INC reform initiatives, we conducted a farmer' survey. Because the INC initiative in each county covered 5 RVs in 2005, 10 RVs in 2006, and 15 RVs in 2007 (Appendix Table 1), we chose to study all participating RVs for each year of the INC initiative. From the villages that participated in the Pengzhou initiative, we randomly selected 9 RVs in 2006 and additional 6 RVs in 2007 (15 total in 2007) for treatment in this study. We also randomly selected 15 RVs from each of the two counties involved in the MOA reform (Appendix Table 1).

For control villages, we randomly selected 15 non-reform villages from each INC county (Appendix Table 1). Because the villages for INC initiative were randomly selected, our control villages in INC counties can be used as base for comparison. Because the Pengzhou initiative was also implemented in one of the two INC initiative counties, we use the same control villages for both initiatives that took place in Pengzhou. In the MOA reform initiative counties, Pixian and Kalaqin, all county villages were involved in the reform. Therefore we selected the two neighboring counties (Doujiangyan in Sichuan and Songshan in IMAR) as non-reform or control counties. In each of these two control counties, we randomly selected 15 non-reform villages as control villages (Appendix Table 1).

From each village (both pilot and control), 10 households were randomly selected to be included in the survey from a list of all famer households provided by the village leaders. In a couple of villages, we accidentally interviewed 11 households. So, in total there were 421 households in 2005, 914 households in 2006, and 1,395 households in 2007 (Appendix Table 1). A survey questionnaire was designed to collect information on the farmers' access to technology services during the years 2005 to 2007. A team of four trained enumerators conducted survey in IMAR and Sichuan at the end of 2007 and the beginning of 2008.

Backgrounds of studied areas, extension agents' income, and agents' service coverage are presented in Tables 2 and 3. On average, each village has about 400–900 households (column 3, Table 2), which is typical in the studied provinces. All farms are small. Average farm size (measured as arable land per household) ranged from 0.16 to 0.41 ha in Sichuan in 2007 (last column,

[2] County level extension agents provide service for whole the county, while township extension agents provide service only to the township where the agents are located.

Table 3
Extension agents' income and their responsible land and households in 2007.

Type of reform initiative	Agent's annual income (CNY)	Responsible arable land per agent (thousand hectares)	Responsible sown area per agent (thousand hectares)	Responsible number of farmer households per agent (thousands)
INC reform initiative and control, non-reform comparison villages				
Wuchuan, IMAR				
INC initiative (reform villages)	21,550	3.07	2.87	1.53
Non-reform (control villages)	16,280	0.56	0.54	0.33
Pengzhou, Sichuan				
INC initiative (reform villages)	26,420	0.31	0.72	1.42
Non-reform (control villages)	21,660	0.39	1.25	3.52
Pengzhou government initiative, MOA reform, and control, non-reform comparison villages				
Pengzhou, Sichuan: Pengzhou initiative	21,970	0.29	0.73	1.56
MOA reform initiative				
Reform county: Kalaqin, IMAR	20,120	0.41	0.37	0.84
Control, non-reform county: Songshan, IMAR	21,030	1.62	1.55	1.60
Reform county: Pixian, Sichuan	24,680	0.37	0.62	1.52
Control, non-reform county: Doujiangyan, Sichuan	24,600	0.08	0.21	0.62

Source: Authors' survey.
Note: The data for the INC and Pengzhou initiatives are based on the pilot villages; for MOA they are the countywide averages.

Table 2). Although per-household land was larger in IMAR, it was still close to 2.5 ha in Wuchuan, 0.38 ha in Kalaqin, and 1.19 ha in Songshan. The annual basic incomes (without year-end bonus) of the agents ranged from CNY 16,280 (about US$2400) to CNY 26,420 (about US$3900) (column 1, Table 3). The variation reflected the differences of local economic situations. Because of variations in the sizes of villages, the responsible number of households per agent also differed among locations (last column, Table 3).

The changes in agricultural extension services are measured by 3A indicators, Availability, Actually received, and Adoption. Availability is measured as the percentage of farmers in the village who saw the RA in the past year. It measures whether or not the reform initiative created more chances for farmers to access the agricultural extension services. Actually received is represented by two indicators, the percentage of farmers who actually received the services provided by the RA and the average number of services each farmer received from the RA in the past year. These two indicators measure the efforts of delivering service. Higher efficiency would be indicated if more farmers actually received services and they received them more frequently. Adoption represents farmer's actual adoption of services received from the RA, which is also measured by two indicators, the percentage of farmers in the villages who adopted the RA's services and the average number of services each farmer adopted from the RA in the past year. These two indicators measure the quality of the services. More farmers adopting the services and each farmer adopting more services would indicate that the agent's services met farmers' demand.

Table 4
Services received and number of techniques adopted by farmers per year 2005–2007.

Type of reform initiative	Availability: saw agents (%)	Actually received: actual received agents' services		Adoption: actual adopted agents' services	
		Percent (%)	Number	Percent (%)	Number
INC reform initiative and control, non-reform comparison villages					
Wuchuan, IMAR					
INC initiative (reform villages)	91.0	84.2	1.82	80.1	1.66
Non-reform (control villages)	19.5	18.8	0.22	17.9	0.22
Pengzhou, Sichuan					
INC initiative (reform villages)	84.0	79.0	2.30	74.3	1.93
Non-reform (control villages)	36.6	34.6	0.76	33.6	0.73
Pengzhou government initiative, MOA reform, and control, non-reform comparison villages					
Pengzhou, Sichuan: Pengzhou initiative	68.3	57.2	1.28	56.8	1.23
MOA reform initiative					
Reform county: Kalaqin, IMAR	89.7	84.5	2.57	83.2	2.25
Control, non-reform county: Songshan, IMAR	67.9	64.2	1.56	63.0	1.50
Reform county: Pixian, Sichuan	43.4	36.1	0.60	35.1	0.46
Control, non-reform county: Doujiangyan, Sichuan	27.0	25.0	0.39	22.7	0.33

Source: Authors' survey.

Table 4 shows the summary results of the changes in agricultural extension services received by farmers in the reform and non-reform villages. Results indicate that more farmers in each reform village had seen the RAs over the course of a year and had accepted and adopted the RAs' services than in the control villages. For the INC reform initiative, the percentages of farmers who saw extension agents were 91.0% and 84.0% in Wuchuan and Pengzhou respectively, which were 71.5% and 47.4% points higher than those who saw their agents in the non-reform villages in the two counties (Wuchuan 19.5% and Pengzhou 36.6%). In the Pengzhou initiative, 68.3% of farmers saw the RAs, which was 31.7% points higher than in the non-reform villages in the county (36.6%). The percentages of farmers who saw the RAs in the MOA reform initiative were 89.7% and 43.4% in Kalaqin and Pixian respectively, which were 21.8% and 16.4% points higher than those in the two control, non-reform villages in Songshan and Doujiangyan (67.9% and 27.0%).

All reform initiatives increased the chances of farmers' receiving services from the RAs. The percentages of farmers who received services from the RAs in the INC reform initiative were 84.2% and 79.0% in Wuchuan and Pengzhou respectively, which were much higher than those in the non-reform villages in the same two counties (18.8% and 34.6%). Similarly, the average numbers of services received per farmer in the INC reform initiative were 1.82 and 2.30 in Wuchuan and Pengzhou respectively, in both instances much higher than in the non-reform villages in the same two counties (0.22 and 0.76). The percentage of farmers receiving services and the number of services received in the Pengzhou initiative initiative were 57.2% and 1.28. These were 22.6% and 0.52 more than in the non-reform villages in the county (34.6% and 0.76 respectively). On average, percentages of farmers who received services in the MOA reform initiative in Kalaqin and Pixian were 84.5% and 36.1%, while they were only 64.2% and 25.0% in the two control, non-reform counties (Songshan and Doujiangyan). Similarly, farmers in the MOA reform initiative in Kalaqin and Pixian received an average of 2.57 and 0.6 services, compared with 1.56 and 0.39 services in the control, non-reform villages in Songshan and Doujiangyan.

All reform initiatives also induced adoption of more agricultural technologies introduced by the RAs. For example, on average, 80.1% and 74.3% farmers in the INC reform initiative in Wuchuan and Pengzhou adopted the new technologies provided by the RAs. These were 62.2% and 40.7% points higher than in the non-reform villages in the same two counties (17.9% and 35.6%). Farmers in the INC reform initiative villages adopted an average of 1.66 (Wuchuan) and 1.93 (Pengzhou) new technologies, while these numbers in the non-reform villages in the same two counties were only 0.22 and 0.73. Similar results were also found for

Table 5a
Estimates of probit model on farmers' access, actually received, and adoption of services: INC reform initiative, 2005–2007.

	Original model			Marginal effects		
	Availability: saw agents	Actually received: actual received agents' services	Adoption: actual adopted agents' services	Availability: saw agents	Actually received: actual received agents' services	Adoption: actual adopted agents' services
Control non-reform villages						
Constants (α_0)	−1.188***	−0.821***	−0.797***			
	(0.30)	(0.29)	(0.29)			
Non-reform villages * D_{2006} (α_1)	0.092	0.072	0.060	0.036	0.029	0.024
	(0.11)	(0.11)	(0.11)	(0.04)	(0.04)	(0.04)
Non-reform villages * D_{2007} (α_2)	0.090	0.080	0.080	0.036	0.032	0.032
	(0.11)	(0.11)	(0.11)	(0.04)	(0.04)	(0.04)
INC reform initiative variables						
Reform villages (β_0)	1.638***	1.349***	1.235***	0.570***	0.497***	0.463***
	(0.17)	(0.16)	(0.15)	(0.05)	(0.05)	(0.05)
Reform villages * D_{2006} (β_1)	0.142	0.261	0.179	0.056	0.104	0.071
	(0.18)	(0.17)	(0.16)	(0.07)	(0.07)	(0.06)
Reform villages * D_{2007} (β_2)	0.449**	0.485***	0.497***	0.173***	0.190***	0.196***
	(0.18)	(0.16)	(0.16)	(0.07)	(0.06)	(0.06)
Farmer characteristics variables (γ)						
AGE (years)	−0.005	−0.011**	−0.012***	−0.002	−0.004**	−0.005***
	(0.005)	(0.004)	(0.004)	(0.002)	(0.002)	(0.002)
EDU (years)	0.051***	0.039***	0.038***	0.020***	0.016***	0.015***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
OFFFARM (100 days)	−0.118***	−0.091**	−0.084*	−0.047***	−0.036**	−0.033*
	(0.04)	(0.04)	(0.04)	(0.02)	(0.02)	(0.02)
CADRE (Yes = 1,No = 0)	0.546***	0.583***	0.509***	0.205***	0.225***	0.200***
	(0.12)	(0.12)	(0.12)	(0.04)	(0.04)	(0.04)
HSIZE (persons)	0.056*	0.039	0.036	0.023*	0.016	0.014
	(0.03)	(0.03)	(0.03)	(0.01)	(0.01)	(0.01)
LABOR (%)	−0.001	−0.0004	0.0002	−0.0003	−0.0002	0.0001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
HRSIZE (100 m^2)	0.323***	0.321***	0.307***	0.128***	0.128***	0.122***
	(0.09)	(0.08)	(0.08)	(0.03)	(0.03)	(0.03)
LAND (hectares)	−0.055***	−0.044**	−0.038*	−0.022***	−0.017**	−0.015*
	(0.02)	(0.02)	(0.02)	(0.01)	(0.01)	(0.01)
Log likelihood	−742.92	−792.44	−820.70	−742.92	−792.44	−820.70

Notes: 1) Values in parentheses are standard errors; 2) * and ** represent levels of significance at 5% and 1% respectively; 3) Each equation has 1565 observations, including the samples in rows (1)–(3) and (5) in Appendix Table 1.

the Pengzhou initiative and the MOA reform initiative in Kalaqin and Pixian, though their observed impacts were smaller than those found in the INC reform initiative villages.

4. The effect of inclusive public agricultural extension service

4.1. Model and estimation

To assess the effectiveness of public extension reforms in China, we used the 3A indicators with the five measures discussed above. The model below is designed to estimate the impact of each of four reform initiatives:

$$A_{ijkt} = \alpha_0 + \alpha_1 D_{2006} + \alpha_2 D_{2007} + (\beta_0 + \beta_1 D_{2006} + \beta_2 D_{2007}) R_{kt} + \gamma X_{ijkt} + \varepsilon_{ijkt} \quad (1)$$

where A_{ijkt} is the effectiveness indicator variable for the jth farmer in the ith village ($i=1$ or 2, indicating reform or non-reform village) for kth initiative (one of four initiatives: one INC initiative, one Pengzhou initiative, and two MOA initiatives) in year t. 3A indicators with the five measures for each reform initiatives were used to evaluate the reform effect. R_{kt} is dummy variable for one of four reform initiatives, where R_{kt} equals 1 if a reform initiative was implemented in the village, otherwise R_{kt} equals zero. X_{ijkt} is a vector of the characteristics of farmers and households. Household characteristic variables (X_{ijkt}) and year dummies (D_{2006} and D_{2007}) are control variables. X_{ijkt} include household head's information, age (AGE), years of education (EDU) and off-farm working days per year (OFFFARM), and overall household characteristics, the later include whether there is a village cadre in the household (CADRE), household size (HSIZE), proportion of off-farm labor force (LABOR), residential area (HRSIZE), and arable land (LAND). ε_{ijkt} is the error term. β_0, $\beta_0+\beta_1-\alpha_1$ and $\beta_0+\beta_2-\alpha_2$ are the effects of the reform in 2005, 2006 and 2007 respectively.

For each of four initiatives, the probit model (Maddala, 1983) and zero-inflated Poisson (ZIP) model (Cameron & Trivedi, 1996; Cragg, 1971; Greene, 2002) are used to estimate Eq. (1). The probit model is used for dependent variables with a 0–1 indicator, they are Availability, Actually received, and Adoption. The results are presented in Tables 5a, 5b, 5c and 5d for INC reform initiative, Pengzhou initiative, and two MOA reform initiative, respectively. The ZIP model is used to estimate the number of extension service received or adopted by farmers, the results are presented in Table 6.

Table 5b
Estimates of probit model on farmers' access, actually received, and adoption of services: Pengzhou local government reform initiative, 2006–2007.

	Original model			Marginal effects		
	Availability: saw agents	Actually received: actual received agents' services	Adoption: actual adopted agents' services	Availability: saw agents	Actually received: actual received agents' services	Adoption: actual adopted agents' services
Control non-reform villages						
Constants (α_0)	−1.128**	−1.152***	−1.121**			
	(0.44)	(0.44)	(0.44)			
Non-reform villages * D_{2007} (α_2)	0.173	0.178	0.140	0.069	0.070	0.055
	(0.13)	(0.13)	(0.13)	(0.05)	(0.05)	(0.05)
Pengzhou local government reform initiative variables						
Reform villages (β_0)	0.761***	0.336**	0.327**	0.296***	0.132**	0.128**
	(0.16)	(0.16)	(0.16)	(0.06)	(0.06)	(0.06)
Reform villages * D_{2007} (β_2)	0.180	0.456***	0.484***	0.072	0.180***	0.190***
	(0.18)	(0.17)	(0.17)	(0.07)	(0.07)	(0.07)
Farmer characteristics variables (γ):						
AGE (years)	−0.005	−0.005	−0.005	−0.002	−0.002	−0.002
	(0.01)	(0.01)	(0.01)	(0.003)	(0.003)	(0.003)
EDU (years)	0.074***	0.075***	0.076***	0.030***	0.029***	0.030***
	(0.02)	(0.02)	(0.02)	(0.01)	(0.01)	(0.01)
OFFFARM (100 days)	−0.096*	−0.106**	−0.097*	−0.038*	−0.041**	−0.038*
	(0.05)	(0.05)	(0.05)	(0.02)	(0.02)	(0.02)
CADRE (Yes = 1,No = 0)	0.452**	0.592***	0.495**	0.177**	0.232***	0.196**
	(0.21)	(0.21)	(0.21)	(0.08)	(0.08)	(0.08)
HSIZE (persons)	0.070	0.033	0.040	0.028	0.013	0.016
	(0.06)	(0.06)	(0.06)	(0.02)	(0.02)	(0.02)
LABOR (%)	0.003	0.005***	0.004**	0.001	0.002***	0.002**
	(0.002)	(0.002)	(0.002)	(0.001)	(0.001)	(0.001)
HRSIZE (100 m^2)	−0.022	−0.049	−0.061	−0.009	−0.019	−0.024
	(0.12)	(0.12)	(0.12)	(0.05)	(0.05)	(0.05)
LAND (hectares)	0.989	1.294*	1.062	0.394	0.506*	0.413
	(0.71)	(0.70)	(0.70)	(0.28)	(0.28)	(0.27)
Log likelihood	−427.09	−428.14	−428.31	−427.09	−428.14	−428.31

Notes: 1) Values in parentheses are standard errors; 2) * and ** represent levels of significance at 5% and 1% respectively; 3) Each equation has 699 observations, including the samples in rows (4) and (5) in Appendix Table 1.

4.2. The estimation results

The estimated results show that about half of coefficients are statistically significant, and many of them are consistent across three reform initiatives. Among control variables, EDU, OFFFARM, and CADRE are important factors that have impacts on availability, actually received and adoption of extension service provided by the RAs. For example, the significant and positive sign of the coefficient for EDU in the probit model for all three reform initiatives indicates that the higher the educational level of farmers, the more willing they were to accept the services and adopt the technologies that the agents supplied (Tables 5a–5d). The positive coefficients for variable CADRE indicate that a family with one or more cadres was more likely to receive services from the extension agents and to adopt the new technologies. It is not unusual for a family with a village cadre to be the contact point for the extension agent in the village. The negative coefficient of OFFFARM is expected. It indicates that the more a household head works off farm, the less likely he or she is to get in touch with the extension agent and the fewer chances he or she has to accept and adopt services. Insignificant coefficients for the AGE and HSIZE in most regression indicate that there is no difference of extension services for household age with different ages or household size (Tables 5a–5d and 6).

The most important and consistent finding is coefficients of the reform initiatives are positive and statistically significant. In the rest of this section, the impacts of the reform initiatives on access to, actually received of, and adoption of extension services are discussed.

4.2.1. Impacts of the reform initiatives on availability

The estimated results show that the reform initiatives had significant impacts on availability of the RAs' services to farmers (columns 1 and 4, Tables 5a–5d). Farmers from the villages with the INC reform initiative (compared to non-reform, control villages in the same county) were 57% more likely to meet the RAs in 2005 (row 4, column 4, Table 5a). Insignificant coefficients for Reform villages intersected with year dummy (D_{2006}) show that the impact in 2006 was similar to that found in 2005. Interestingly, the impact was even larger in 2007 than those in 2005 and 2006 as the estimated coefficient was positive and significant for year 2007 (row 6, column 4, Table 5a). The impacts of the Pengzhou Government and MOA initiatives were also statistically significant, but the impacts were lower than those found for the INC initiative. For example, farmers Pengzhou government initiative villages increased their chances to meet the RAs by 29.6% (row 3, column 4, Table 5b), and farmers under two MOA's initiatives increased theirs by 24.4 percent (row 2, column 4, Table 5c) and 22.6% (row 3, column 4, Table 5d), respectively. These results may reflect differences in efforts and designs among the four initiatives, as presented in Table 1. The greater impact observed in the INC initiative may also be partially due to the pilot INC initiative receiving more attention than the subsequent scale-up in the Pengzhou government and MOA initiatives.

Table 5c
Estimates of probit model on farmers' access, actually received, and adoption of services: MOA reform initiative — Kalaqin, 2006–2007.

	Original model			Marginal effects		
	Availability: saw agents	Actually received: actual received agents' services	Adoption: actual adopted agents' services	Availability: saw agents	Actually received: actual received agents' services	Adoption: actual adopted agents' services
Control non-reform villages						
Constants (α_0)	0.081	−0.414	−0.512			
	(0.64)	(0.60)	(0.60)			
MOA reform initiative variables						
Reform villages (β_0)	1.018***	0.847***	0.810***	0.244***	0.248***	0.249***
	(0.20)	(0.19)	(0.18)	(0.05)	(0.05)	(0.05)
Farmer characteristics variables (γ)						
AGE (years)	−0.013	−0.003	−0.003	−0.003	−0.001	−0.001
	(0.01)	(0.01)	(0.01)	(0.002)	(0.003)	(0.003)
EDU (years)	0.115***	0.088***	0.088***	0.028***	0.027***	0.028***
	(0.04)	(0.03)	(0.03)	(0.01)	(0.01)	(0.01)
OFFFARM (100 days)	−0.150	−0.120	−0.162*	−0.037	−0.036	−0.051*
	(0.10)	(0.09)	(0.09)	(0.02)	(0.03)	(0.03)
CADRE (Yes = 1,No = 0)	1.201**	0.967***	0.560*	0.179***	0.207***	0.149**
	(0.50)	(0.38)	(0.30)	(0.04)	(0.05)	(0.06)
HSIZE (persons)	−0.006	0.002	0.018	−0.002	0.001	0.006
	(0.07)	(0.06)	(0.06)	(0.02)	(0.02)	(0.02)
LABOR (%)	−0.001	−0.001	−0.001	−0.0003	−0.0002	−0.0003
	(0.003)	(0.003)	(0.003)	(0.001)	(0.001)	(0.001)
HRSIZE (100 m^2)	0.045	0.075	0.112	0.011	0.022	0.035
	(0.15)	(0.15)	(0.15)	(0.04)	(0.04)	(0.06)
LAND (hectares)	0.107	0.145	0.132	0.026	0.043	0.042
	(0.12)	(0.11)	(0.11)	(0.03)	(0.03)	(0.04)
Log likelihood	−139.32	−161.71	−167.85	−139.32	−161.71	−167.85

Notes: 1) Values in parentheses are standard errors; 2) * and ** represent levels of significance at 5% and 1% respectively; 3) each equation has 320 observations, including the samples in rows (6) and (7) in Appendix Table 1.

4.2.2. Impacts of the reform initiatives on actually received service

The estimation results show that the reform initiatives had significant impacts on farmers' actually received of the agents' services (columns 2 and 5, Tables 5a–5d; column 1–4, Table 6). Farmers from the villages with the INC reform initiative were 49.7% more likely to receive the RA's services relative to the farmers from the control villages (row 4, column 5, Table 5a), and additional impact of 19% was obtained in 2007 compared to that in 2005–2006 (row 6, column 5, Table 5a). Farmers from the villages with the INC reform initiative received services provided by the RAs 0.685 more times per year than did farmers in the control villages in 2005 (row 4, column 1 row 1, Table 6), and the impact had been kept the same level in 2006 and 2007 (rows 5 and 6). Farmers from the villages with the Pengzhou initiative were 13.2% more likely to receive the agents' services (row 4, column 5, Table 5b), however, there was no significant difference in the number or times farmers accepted the service (row 4 and 6, column 2, Table 6).

Similar to the effects of the reform initiatives on farmers' access to the services, the results show that MOA reform initiatives also had significant impacts on the farmers' actually received of services in two MOA initiatives (Tables 5c and 5d). For example, compared with farmers from non-reform, control villages in Kalaqin and Pixian, under MOA initiative 24.8 (row 2, column 5, Table 5c) and 18% (row 3, column 5, Table 5d) more farmers received the RA's services, respectively. They also received services from the RAs about 0.349 more times per year in Kalaqin (row 4, column 3, Table 6), and there was no significant difference in the number or times farmers accepted the service in Pixian (row 4 and 6, column 4, Table 6).

4.2.3. Impacts of the reform initiatives on adoption

The estimation results show that, in most cases, there were also significant impacts on farmers' adoption of technologies offered by the RAs (columns 3 and 6, Tables 5a–5d; columns 5–8, Table 6). Compared with farmers in the non-reform villages, farmers in the villages with the INC reform initiative were 46.3% more likely to adopt the agent's services in 2005 (row 4, last column, Table 5a). They also adopted new technologies from the RA's services 0.533 more times per year than did the farmers in the control villages in 2005 (row 4, column 5, Table 6). Consistent with the findings on service availability and actually received, we also found that the impact of the INC reform initiative on adoption was larger than Pengzhou and MOA's initiatives (last column of Tables 5a–5d and last two columns of Table 6), which indicates that the INC initiative had significant more impacts on farmers' adoption of new services provided by the RAs.

Table 5d
Estimates of probit model on farmers' access, actually received, and adoption of services: MOA reform initiative — Pixian, 2006–2007.

	Original model			Marginal effects		
	Availability: saw agents	Actually received: actual received agents' services	Adoption: actual adopted agents' services	Availability: saw agents	Actually received: actual received agents' services	Adoption: actual adopted agents' services
Control non-reform villages						
Constants (α_0)	−2.127***	−2.158***	−2.289***			
	(0.44)	(0.45)	(0.45)			
Non-reform villages * D_{2007} (α_2)	0.424***	0.438***	0.336**	0.160**	0.158**	0.117*
	(0.16)	(0.17)	(0.17)	(0.06)	(0.06)	(0.06)
MOA reform initiative variables						
Reform villages (β_0)	0.625***	0.530***	0.556***	0.226***	0.180***	0.184***
	(0.17)	(0.17)	(0.17)	(0.06)	(0.06)	(0.05)
Reform villages * D_{2007} (β_2)	0.0906	0.016	−0.003	0.034	0.006	−0.001
	(0.15)	(0.15)	(0.15)	(0.06)	(0.05)	(0.05)
Farmer characteristics variables (γ)						
AGE (years)	0.014**	0.017***	0.017***	0.005**	0.006***	0.006***
	(0.01)	(0.01)	(0.01)	(0.002)	(0.002)	(0.002)
EDU (years)	0.063***	0.059***	0.060***	0.023***	0.020***	0.020***
	(0.02)	(0.02)	(0.02)	(0.01)	(0.01)	(0.01)
OFFFARM (100 days)	−0.024	0.023	0.048	−0.009	0.008	0.016
	(0.06)	(0.06)	(0.06)	(0.02)	(0.02)	(0.02)
CADRE (Yes = 1,No = 0)	0.876***	0.815***	0.802***	0.338***	0.310***	0.301***
	(0.22)	(0.21)	(0.21)	(0.08)	(0.08)	(0.08)
HSIZE (persons)	−0.062	−0.083	−0.093*	−0.023	−0.028	−0.031*
	(0.05)	(0.05)	(0.05)	(0.02)	(0.02)	(0.02)
LABOR (%)	0.003	0.001	0.001	0.001	0.0004	0.0004
	(0.002)	(0.002)	(0.002)	(0.001)	(0.001)	(0.001)
HRSIZE (100 m^2)	0.150***	0.119**	0.122**	0.055***	0.041**	0.041**
	(0.05)	(0.05)	(0.05)	(0.02)	(0.02)	(0.02)
LAND (hectares)	0.002	0.016	0.035	0.001	0.006	0.012
	(0.04)	(0.04)	(0.03)	(0.01)	(0.01)	(0.01)
Log likelihood	−349.65	−338.42	−329.21	−349.65	−338.42	−329.21

Notes: 1) Values in parentheses are standard errors; 2) * and ** represent levels of significance at 5% and 1% respectively; 3) Each equation has 602 observations, including the samples in rows (8) and (9) in Appendix Table 1.

Table 6
Estimates of *ZIP* model on farmer's actually received and adoption of the agents' agricultural technology services per year, 2005–2007.

Variables	Number–actually received: times farmers accepted the services				Number–adoption: number of services adopted per farmer			
	INC reform initiative	Pengzhou local government reform initiative	MOA reform initiative — Kalaqin	MOA reform initiative — Pixizn	INC reform initiative	Pengzhou local government reform initiative	MOA reform initiative — Kalaqin	MOA reform initiative — Pixizn
Control non-reform villages								
Constants (α_0)	0.399	0.318	1.032***	−1.285	−0.094	−0.189	1.089***	−0.355
	(0.27)	(0.53)	(0.34)	(0.82)	(0.30)	(0.56)	(0.34)	(0.72)
Non-reform villages * D_{2006} (α_1)	0.105				0.145			
	(0.16)				(0.17)			
Non-reform villages * D_{2007} (α_2)	0.210	0.097		0.090	0.268	0.132		−0.334
	(0.16)	(0.13)		(0.26)	(0.16)	(0.14)		(0.29)
INC reform initiative variables								
Reform villages (β_0)	0.685***	0.177	0.349***	−0.013	0.533***	0.148	0.232**	0.262
	(0.15)	(0.16)	(0.10)	(0.25)	(0.17)	(0.17)	(0.11)	(0.25)
Reform villages * D_{2006} (β_1)	−0.035				−0.011			
	(0.10)				(0.12)			
Reform villages * D_{2007} (β_2)	0.092	−0.186		0.151	0.156	−0.149		−0.004
	(0.10)	(0.14)		(0.19)	(0.12)	(0.15)		(0.19)
Farmer characteristics variables (γ)								
AGE (years)	−0.007*	0.001	−0.011**	0.027**	−0.002	0.008	−0.013**	0.016**
	(0.004)	(0.01)	(0.01)	(0.01)	(0.004)	(0.01)	(0.01)	(0.01)
EDU (years)	−0.011	0.023	0.035*	−0.070**	0.010	0.038	0.026	−0.079**
	(0.01)	(0.03)	(0.02)	(0.03)	(0.01)	(0.03)	(0.02)	(0.04)
OFFFARM (100 days)	−0.041	−0.015	0.023	−0.078	−0.021	−0.001	−0.026	−0.054
	(0.03)	(0.04)	(0.05)	(0.10)	(0.04)	(0.04)	(0.06)	(0.08)
CADRE (Yes = 1, No = 0)	0.004	0.274*	0.354***	0.030	−0.049	0.144	0.289**	0.827***
	(0.08)	(0.16)	(0.11)	(0.22)	(0.09)	(0.16)	(0.12)	(0.21)
HSIZE (persons)	0.053**	−0.037	−0.115***	0.106	0.040	−0.062	−0.075*	−0.181
	(0.03)	(0.05)	(0.04)	(0.07)	(0.03)	(0.05)	(0.04)	(0.07)
LABOR (%)	0.000	0.008***	0.001	−0.004	0.001	0.008***	0.001	−0.005
	(0.001)	(0.002)	(0.002)	(0.004)	(0.001)	(0.002)	(0.002)	(0.004)
HRSIZE (100 m^2)	0.076	−0.028	0.244***	0.064*	0.112	0.039	0.166*	0.108***
	(0.07)	(0.13)	(0.08)	(0.04)	(0.07)	(0.13)	(0.10)	(0.04)
LAND (hectares)	−0.094***	−0.498	0.079	−0.110	−0.054**	−0.561	0.096*	−0.148**
	(0.02)	(0.57)	(0.05)	(0.07)	(0.02)	(0.60)	(0.06)	(0.06)
Log likelihood	−1881.98	−843.05	−547.04	−538.81	−1788.67	−817.52	−520.65	−446.28
Observations	1565	699	320	602	1565	699	320	602

Note: 1) Values in parentheses are z-ratios; 2) * and ** represent levels of significance at 5% and 1% respectively.

5. Conclusions and implications

This paper describes and analyzes the impacts of the recent reform initiatives to promote inclusive public agricultural extension services in rural China. The effect of these reforms on the farmers' access to, actually received of, and adoption of agricultural extension services are examined using data collected from 135 villages in Inner Mongolia Autonomous Region and Sichuan from 2005 to 2007. Two major conclusions have been reached. First, the introduction of all reform initiatives considered in this study increased the availability and actually received of public agricultural extension services for all farmers, and farmers actually adopted more public extension services in the reform villages than in the non-reform villages. Second, the farmers under the initial pilot inclusive reform initiative were more likely to receive, accept, and adopt the agricultural extension services than those under later reform initiatives that used some of the major components of the initial pilot reform.

There are four distinctive features of these reform initiatives: the inclusiveness of all farmers as targets for public extension service, a systematic approach to identifying local farmers' needs for extension services, accountability of the extension agents for providing services, and incentives provided to the extension agents for their services. Targeting all farmers for the public extension services and taking a systematic approach to identifying the farmers' needs are necessary conditions for inclusive public extension because these features made the service providers (extension agents) understand better what services farmers actually demand. These are not, however, sufficient conditions for a successful inclusive extension reform. Accountability through the

extension agent's commitment (or promise) and incentives based on a well-designed annual evaluation method are also critically important in the reform initiatives studied in this paper.

The findings of the study have several policy implications. First, China should continue its current agricultural extension reform by scaling up the pilot initiatives to the rest of the country. While China's top–down agricultural extension system played an important role in its agricultural development under the planned economy and in the early reform period of the 1980s, the traditional top–down extension model can hardly meet diversified demand for agricultural extension services by millions of small farmers.

Second, it should be recognized that a shift from a top–down to a bottom-up approach is challenging and requires strong political commitment from the local government. It is common sense that attention from leaders and extension agents during the pilot reform period often diminishes during the scale-up period. Our analyses provide some indirect evidence of this phenomenon: The impacts of the initial, pilot inclusive reform in Wuchuan and Pengzhou were much larger than those in other counties where the reform was implemented on a larger scale.

Third, reform requires substantial effort in improving the human capital of extension staff (agents). As mentioned earlier, in the Introduction and problem statements, many township-level extension organizations have either disappeared or ceased to function well. Hiring new extension staff and improving their skill for inclusive public extension service should be carefully considered when reform is implemented.

Finally, reform requires substantial investment. While this study does not examine the cost of the reform initiatives, which is also one major limitation of the study, providing an incentive (monetary bonus) and maintaining a large public extension system are clearly not without additional costs.

Appendix A

Appendix Table 1
Number of intervention and sampling villages and farmers in 2005–2007.

	Number of intervention villages			Number of sampling villages[b]			Number of sampling farmers[b]			
	2005	2006	2007	2005	2006	2007	2005	2006	2007	Total
INC initiative in Wuchuan (1)	5	10	15	5	10	15	53	104	154	311
Non-INC initiative in Wuchuan (2)[a]				15	15	15	166	166	166	498
INC initiative in Pengzhou (3)	5	10	15	5	10	15	50	100	150	300
Pengzhou initiative in Pengzhou (4)		22	130	0	9	15	0	91	152	243
Non-INC/non-Pengzhou initiative in Pengzhou (5)[a]				15	15	15	152	152	152	456
MOA initiative in Kalaqin (6)	0	0	271	0	0	15	0	0	155	155
Non-MOA initiative in Songshan (7)	0	0	0	0	0	15	0	0	165	165
MOA initiative in Pixian (8)[a]	0	162	162	0	15	15	0	151	151	302
Non-MOA initiative in Dujiangyan (9)[a]	0	0	0	0	15	15	0	150	150	300
Total (10)	10	204	593	40	89	135	421	914	1395	2730

[a] The villages and farmers surveyed are the same ones over time.
[b] The villages and farmers in each pilot village surveyed in preview years were also surveyed in the current year.

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