



Mitigating land pollution through pesticide packages – The case of a collection scheme in Rural China

Shuqin Jin ^{a,b,*}, Bettina Bluemling ^c, Arthur P.J. Mol ^b

^a Research Center for Rural Economy, Ministry of Agriculture, No. 56 Zhuanta Hutong Xisi Xicheng, District Beijing, China

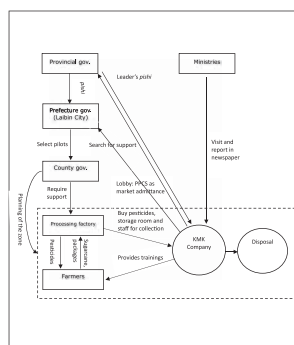
^b Environmental Policy Group, Wageningen University, The Netherlands

^c Copernicus Institute of Sustainable Development, Faculty of Geoscience, Utrecht University, The Netherlands

HIGHLIGHTS

- Pesticide package collection schemes are feasible in low income countries.
- Private collection schemes' environmental benefits remain ambiguous.
- Private collection schemes can shape future political economic structures.
- Governmental support is still of importance for the success of a scheme.
- Institutional arrangements with mutual resource dependency need monitoring.

GRAPHICAL ABSTRACT



Interactions among actors in Guangxi PPCS.

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ABSTRACT

Pesticide packages that are discarded on agricultural land can contaminate water bodies and pose a threat to the environment and human health. Little is known about how developing countries deal with this kind of land pollution. While in developed countries, packages are collected by professional organizations, the smallholder context in developing countries makes the collection of this waste much more difficult. This paper introduces and analyses a successful Pesticide Package Collection Scheme in one of the poorest regions in China, i.e. Guangxi Province. The purpose of the paper is to analyze and discuss how such a scheme can be established by multiple actors. The paper finds that the underlying success factors for establishing such a scheme are 1.) that a scheme piggy-backs on existing economic structures that reach out to farmers (e.g. associations); 2.) that the scheme itself facilitates actors' exchange of resources to establish a temporary resource equilibrium; 3.) that all stakeholders obtain returns on their investment, even if the quality and time scale of these returns may differ. The initiation of the scheme by a pesticide company however increased both its political and market influence. Caution hence has to be paid to whether the short-term improvement in land pollution happens at the expense of a dependency on and increased use of certain kinds of pesticides.

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1. Introduction

For several decades, China has been the largest consumer of pesticides in the world (Sun et al., 2012), with a total consumption of 1.8 million tons (trading quantity) in 2013 (National Bureau of Statistics

* Corresponding author at: Research Center for Rural Economy, Ministry of Agriculture, No. 56 Zhuanta Hutong Xisi Xicheng, District Beijing, China.
E-mail address: jinshuqin@126.com (S. Jin).

of China, 2014). Accordingly, extensive research has been carried out into pesticides overuse and how pesticide use may be reduced (e.g. Hu and Rahman, 2015; Jin et al., 2015; Wang et al., 2015; Zhang et al., 2015; Liu and Huang, 2013). However, there has been a dearth of research on a problem related to the extensive use of pesticides, i.e. the disposal of empty pesticide packaging on agricultural fields. A survey by the Research Center for Rural Economy (RCRE) showed that 62% of Chinese farmers randomly dump pesticide packages into or nearby water bodies after they applied the pesticides (Wei and Jin, 2014). It is estimated that annually, over 3.2 billion pesticide packages are discarded in such a way in China. The packaging waste weighs over 100,000 tons, and residue pesticides from these packages account for 2%–5% of the total weight of pesticides used (Jiao et al., 2012). The environmental harm of these discarded pesticide packages is evident: residues pollute the water and soil ecosystem, and can impact the health of humans and animals. Furthermore, most of the packages are made of plastic, which will not easily degrade, and will impact soil quality.

Research on the pollution of land and water bodies in China by waste that accrues in the process of agricultural production has so far focused on plastic mulching (Dai and Dong, 2014; Liu et al., 2014). Here, biodegradable plastics have become a viable solution (Liu et al., 2014). However, this solution is less applicable for pesticide packaging, given the nature of the plastics required. Therefore, arrangements have to be made how to collect this diffuse plastic waste so that it can be properly disposed.

Internationally, some examples exist for such collection schemes. In Brazil, in 2002, by passing Decree 4074/02, actors within the agricultural value chain (including e.g. retailers, cooperatives, government authorities, farmers) became responsible for the proper disposal of agrochemical packages. In 2009, 94% of pesticide packages were collected, which made Brazil a frontrunner in the disposal of pesticide packaging wastes (InpEv, 2011). FAO/WHO in 2008 published a guideline outlining different management schemes and existing practices to collect, recycle and dispose of pesticide packages. The guideline also lists successful schemes in developed countries such as Germany, Canada, Australia, and France (FAO/WHO, 2008). In these countries, packages are collected by professional organizations like companies or associations which were jointly established with pesticide companies. However, not much research, to the authors' knowledge, has been conducted on schemes where pesticide packaging collection is foremost undertaken by individual farmers. These schemes are likely to be more relevant in smallholder contexts that require more decentralized collection structures.

Literature confirms that without such schemes, pesticide packages are likely to lead to land and water pollution. Damalas et al. (2008) provide an overview of farmers' disposal practices in a region in Greece, and find evidence of farmers either dumping empty containers in the field, or throwing them near or into irrigation canals or streams, if not burning them in open fires. Similar findings are reported for Oman (Said Al Zadjali et al., 2013), Vietnam (Pham Van Hoi et al., 2009), South Africa (Dalvie et al., 2006), Ethiopia (Mengiste et al., 2015, 2016) and Tanzania (Nonga et al., 2011). These studies reveal that especially in developing countries, the problem of pesticide package collection has not been tackled yet.

Despite the severity of the problem in China, so far not much research has been conducted. The only publication in English that looks into the question of land pollution through pesticide packaging is Yan (2014). In her dissertation, Yan shows that about three-quarter of surveyed vegetable farmers in Hunan Province, China, dispose of pesticide packages in the field. Otherwise, a search of Chinese journals online CAJD,¹ using “topic = (pesticide packaging wastes) OR (pesticide package)” within the “Core Journals” returned only seven papers, from

which the earliest paper was published in 2010. Of the seven papers, Cai (2013) presents the results of a survey about farmers' willingness to accept different kinds of pesticide package collection schemes. He and Jin (2013) analyze international experiences of pesticide package collection schemes, while Wei and Jin (2014) present the case of Shanghai's pesticide collection scheme. In Shanghai, as the richest region in China and with a rather low share of agriculture (0.6% of its regional GDP in 2013), public finance has subsidized up to 80% of farmers' costs on pesticides. Under this scheme, farmers only receive pesticide subsidies if they return empty packages to the governmental collection station. As reported by Wei and Jin (2014), it is unlikely for other parts of China to learn from Shanghai as the low share of agriculture in regional GDP and Shanghai's overall economic development are hardly representative for the rest of China.

Not only is there a lack of academic attention to pollution from pesticide packages, Chinese policy so far has paid little attention to this problem. In China, the problem of agricultural plastic waste in rural areas has only recently become the object of policy-making. A review of Chinese government documents (e.g. including laws, regulations, governmental announcements) revealed that pesticide packaging waste was first dealt with, on a national level, in 2011, i.e. by the “Technical guideline on environmentally safe application of pesticides”, a voluntary guideline issued by the Ministry of Environmental Protection (MEP). This guideline stated that “pesticide containers cannot be used for other purposes, and intact containers can be collected by the retailers or producers”. A document issued by the State Council in 2013 states that one of the major tasks to protect soils is “to establish recycling systems for pesticide packages” (State Council, 2013).

Given this dearth of research and policy on collection schemes in China, this article looks at the case of a pesticide packaging waste collection scheme that was set up in Guangxi Province, China. The government of Guangxi is relatively poor and therefore may not necessarily have the means to devise a Pesticide Package Collection Scheme (PPCS) based on subsidies and governmental investment, as in the case of Shanghai. Therefore, the involvement of a private company became pivotal in Guangxi. In this article, we will hence focus on the set up, institutionalization and outcomes of this scheme. We will particularly analyze how actors' investment of different kinds of resources has led to the institutionalization and particular design of the scheme.

The remainder of the paper is organized as follows. Section 2 introduces the study site and outlines the methodology employed. Section 3 shows the result of the Guangxi case. Section 4 discusses the case and draws conclusions.

2. Material and methods

2.1. Study site

The research was carried out in Guangxi Zhuang Autonomous Region (Guangxi) in the south of China. Guangxi is one of the most underdeveloped provinces. In 2013, the Per Capita Gross Regional Product of Guangxi was 30,588 RMB. In terms of development the province ranks 27th out of 31 provinces, with only Tibet, Yunnan, Gansu, and Guizhou having a lower Per Capita Product (NBS, 2014). Agriculture is the province's primary economic sector and accounts for 16.3% of its Gross Regional Product.

The PPCS was initiated by a private pesticide company, with the participation of sugarcane farmers. Guangxi is called the ‘Capital of Sugar’ and is the most important sugar producing province in China, accounting for 67% of the sugar produced in China. Sugarcane is the province's most important cash crop. The sown sugarcane area accounts for 25.2% of the total farming area of the province.

The research was carried out foremost in Laibin Prefecture as this was the first local government that agreed to develop a PPCS with the pesticide company KMK. And two towns (Xiaopingyang Town and Qiaogong Town, both were the first to participate the scheme) were

¹ CAJD (China Academic Journal Network Publishing Database) is the largest database of Chinese academic journals. Almost all papers published in China's journals since 1915 are included. Similar with (Social) Sciences Citation Index, the “Core Journal” is the list which includes the most influential journals based on their quality and citations. Search date is 04-11-2015.

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