



INVITED PAPER

## **Reverse logistics system and the role of government oversight for preservation of water and soil quality: the case of pesticide empty containers**

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### **ABSTRACT**

This paper discusses the reverse logistics of empty agrochemical containers, the partners involved, and it focuses on the participation of the Agricultural Defense Agency of the São Paulo state government in reducing the risk of water and soil contamination in order to preserve these resources for future generations.

**Keywords:** agriculture, chemical control, environmental contamination.

### **O sistema de logística reversa e o papel da fiscalização governamental para a preservação do solo e da água: o caso das embalagens vazias de defensivos agrícolas**

### **RESUMO**

Este trabalho tem por objetivo demonstrar como a logística reversa das embalagens vazias de agrotóxicos funciona, quais são os parceiros envolvidos, focando na participação da Defesa Agropecuária do governo do Estado de São Paulo, na redução dos riscos de contaminação de água e solo, com o objetivo de preservar estes recursos para as gerações futuras.

**Palavras-chave:** agricultura, agrotóxico, contaminação ambiental.

### **1. DISCUSSION**

Considered a regulatory landmark in 1989, a Brazilian federal law first demonstrated the country's concern with the handling and disposal of pesticide containers. Previously, most of the focus was on pesticide efficiency and most of the containers were made of glass, not of plastic as they are today. The environment was still not considered an important concern, and even today Brazil is the largest consumer of pesticides worldwide. The correct handling and

disposal of pesticide containers is therefore of primary importance in public policy. Brazil's Federal Laws 7802 (Brazil, 1989), 9974 (Brazil, 2000) and Decree 4074 (Brazil, 2002) regulate the obligation to return empty pesticide containers to retailers or producers. In 2010, reverse logistics was defined by Federal Law 12305 (Brazil, 2010), which created the National Policy on Solid Waste. According to this law, reverse logistics can be understood as a set of actions, procedures, and means to enable the collection and recovery of solid waste for the business sector to reuse in its cycle, other production cycles, or even to dispose of in an environmentally safe manner. Previously, some people would reuse empty pesticide containers, while others would discard them, and these behaviors risked the contamination of soil and water. The law mandated that pesticide containers be tracked from the moment of sale until their return to a recycler.

### **1.2. Pesticide Packaging Reverse Logistics System – Partners**

Since Brazilian law mandated the return of pesticide containers, a reverse logistics system has been implemented. This system involves different stakeholders such as pesticide producers, farmers, and government. Each has an important role to play in order for the system to be effective.

In 2001, the Instituto Nacional de Processamento de Embalagens Vazias (INPEV) was created in order to develop guidelines to improve the disposal of pesticide packaging. The INPEV is responsible for recycling pesticide containers.

Farmers must return empty pesticide containers to a recycler. The government is responsible for education, inspection and licensing. The Agricultural Defense Agency, which falls under São Paulo State's Department of Agriculture, is responsible for monitoring the sale and use of pesticides. It also monitors the return of empty pesticide containers.

According to Grutzmacher et al. (2006), these efforts have enabled the agricultural sector to achieve reverse logistics results superior to those of any other economic sector: in 2009, Brazil recycled 94% of all plastic packages collected during the year, followed by France (77%) and Canada (73%) (INPEV, 2016).

### **1.3. Government**

Empty pesticide containers have only recently been inspected and controlled by the government. Previously, most of these packages were freely disposed of in rivers or fields, were burned, or even worse, buried in the ground, causing serious environmental damage (Oliveira, 2012).

After purchasing a pesticide, a farmer has one year to return the empty container to a recycler. However, according to Lima et al. (2009), most farmers have ignored this rule. The empty containers must be washed three times (Pelissari et al., 1999) soon after they are emptied in order to reduce product waste. Washed containers may then be sent to a recycler that will send them to a manufacturer who may recycle used containers into new ones.

Since the law's implementation, there have been many lectures and much training regarding triple washing and the importance of pesticide package return. One example is the project called "Vegetables: healthy and safe food" which was conceived and implemented by several chemical supply chain partners (Vieira et al., 2006) and which focuses on providing training and disseminating information that can help farmers better execute the procedures established by law. However, government oversight is an important component for making this process work.

According to INPEV (2016), from 2002 to 2015, the percentage of empty pesticide containers returned by farmers increased more than 1,200 %. In 2002, the quantity was 3,768 tons, and in 2015 this number increased to more than 45,000 tons. This is a very important way to reduce the risks of environmental contamination, as well as to protect the

health of workers and consumers. By analyzing secondary data, it is possible to infer that empty pesticide container return has increased at locations where government exercises oversight.

For Minami et al. (2008), oversight and enforcement, along with consumer awareness, has increased the return of empty containers to the receiving units and subsequently to the recyclers, which in return increases protection of the environment. However, it is important to point out that consumer awareness alone is insufficient to sustain this process of conscious consumption and sustainable production. The state must exercise its command and control power through regulation and oversight in order to protect people and the environment. The government has shown a willingness to provide solutions for environmental problems associated with pesticide usage and recycling by establishing clear policies on the generation, collection, treatment, and disposal of solid waste, as well as sanctions for those who violate the law (Santos, 2009).

Therefore, oversight is needed in order to assure that this system of reverse logistics grows more effective. In the Paraíba River Valley, State of São Paulo, the Agricultural Defense Agency has been randomly monitoring farms, analyzing pesticide sales data and overseeing pesticide packaging return points. In each agency check, farms are supervised in order to verify their pesticide usage, storage, and empty container return receipts. This kind of action is also an instructive intervention that has increased the return of pesticide packaging. It has been found that when nearby farmers become aware of agency oversight, they return their own empty pesticide containers as well. According to Recena and Caldas (2008), most of farmers are aware of the risks of environmental contamination due to the improper disposal of pesticide packaging.

Inspections at recyclers have shown that the number of farmers who return their containers without triple washing has decreased. In the beginning of the reverse logistics system, the Agricultural Defense Agency would analyze return receipts of receiving locations in order to identify farmers who had returned containers without properly washing them. The agency would then provide additional training to those farmers regarding the importance of washing containers correctly and emphasizing their legal obligation to do so.

## 2. FINAL REMARKS

In recent years the State of São Paulo has suffered a water shortage due to the lack of precipitation and the mismanagement of river dams, which has engendered in its population a greater awareness of the importance of preserving and conserving both the quantity and quality of its natural resources. The reverse logistics system promotes the preservation of environmental quality, reducing soil and water contamination caused by the improper disposal of pesticide containers.

Each participant must properly fulfill their obligations in order to assure the success of the system. Therefore, all stakeholders are important, including the government which must educate and, if necessary, obligate others to fulfill their obligations as well. Everyone is responsible for the conservation and preservation of natural resources in order to sustain the well-being of future generations.

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