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At the limits of sustainability: Exploring extended producer responsibility in the management of agrochemical packaging

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Abstract: The study discusses the limitations of take-back schemes for agrochemical packaging in promoting sustainability. Through the case of inPEV and the Campo Limpo System, the analysis focused on data from IBGE, IBAMA, and secondary sources. Results show that the system's organization favors large agricultural producers, particularly in the soybean chain, while small producers are marginalized. Although this strategy allows for high rates of collection, a crucial shortcoming refers to environment and health related effects on family farms. This is embodied in the dilemma that take-back schemes for agrochemical packaging are necessary in terms of adequate waste management, but can create conditions that institutionalize the use of agrochemicals and legitimize their increasing application. Consequently, sustainability in food production systems is a complex and multidimensional affair, which require coordinated effort of civil society, public authorities, and producers.

Keywords: Extended producer responsibility; reverse logistics; inPEV

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Introduction

With the ambition to promote sustainable development (MENG et al., 2020) through services that are socially inclusive and environmentally conservationist (LI; WESTLUND; LIU, 2019; OLIVEIRA; RODRIGUES, 2021), governments around the world have engaged in creating policies based on extended producer responsibility (EPR). This instrument assigns manufacturers the obligation to manage their products until the end-of-life, focusing especially on disposal (LIFSET et al., 2013; LIFSET; LINDHQVIST, 2008; LINDHQVIST; LIDGREN, 1991; OECD, 2001). Among the different ways to implement them, reverse logistic systems known as take-back stand out (OECD, 2001). As the collected materials are used to manufacture new products, a circular economy cycle is generated (KIRCHHER et al., 2017). In Europe, particularly in Scandinavia, there are successful cases of EPRs that operationalize the return of discarded items (JØRGENSEN, 2011; LIFSET et al., 2013; MILJØDIREKTORATET, 2021; NOGUEIRA et al., 2022).

In agriculture, Brazil is a reference in take-back through Campo Limpo System, which reports a collection rate of about 90% per year (INPEV, 2019). Campo Limpo System is a not-for-profit service, created from the obligation that emerged from Law 9.074/2000, which controls the destination of empty agrochemical containers (EAC) in the country, and which has received worldwide recognition (MARNASIDIS et al., 2018). The system's implementation takes place through the National Institute for the Processing of Empty Packaging (inpEV), headquartered in the city of São Paulo, and which has units in all the Brazilian states. Supporting the Campo Limpo System are the main suppliers of agrochemicals (e.g., Basf, Bayer, and Dow Chemicals) as well as organizations active as lobbyists the Federal Senate and the Chamber of Deputies, with emphasis on the Brazilian Association of Soy Producers (Aprosoja) and the Confederation of Agriculture and Livestock of Brazil (Cna). These organizations take part on inpEV either as members or advisers.

While the law mandates that manufacturers of agrochemical products set up an EPR system, it also mandates that farmers join it for their part. Nonetheless, there is a lack of compliance mechanisms, other than Law 9074/2000 itself, which entails fines, bans on the acquisition of new agricultural pesticides and even imprisonment. It is up to public authorities to supervise that EACs are adequately returned to an authorized location, which is a complex task given the continental dimensions of Brazil and its poor infrastructure in certain rural areas. Therefore, although returning EACs is compulsory, further measures are needed to encourage collection.

A central criticism of the Campo Limpo System is that its technical support for the correct handling and disposal of EACs is deficient (MARQUES et al., 2019; MELLO; SCAPINI, 2016; NOGUEIRA; DANTAS, 2013; RODRIGUES et al., 2021). Rigorously cleaning containers before delivering them is crucial, since this is a decisive factor both for mitigating EACs environmental impact and for the operational quality of the recycling operation (PICUNO et al., 2020). Farmers are expected to follow a triple-washing procedure, but not all do it correctly, whether to the procedure's inconvenience, or for a lack of information and awareness (MARQUES et al., 2016; SANTOS et al., 2018; SILVA et al., 2016). In addition to the meticulous additional work, farmers are not remunerated for this work. EPR in other contexts counts with deposit fees that are returned to the holder of a container and that function as an incentive to collection. Nonetheless, this mechanism is not adopted in the Campo Limpo System.

The amount of pesticides applied to agricultural crops increases every year, highlighting the problem of dealing with containers among small farmers (VALADARES et al., 2020). Excessive application of agrochemicals brings serious risks to people's health through intoxication, and to the environment through soil and water contamination (GODECKE; TOLEDO, 2015; LAGARDA-LEYVA et al., 2019; PIGNATI et al., 2017). Improper disposal of containers exacerbates these risks and the subsequent damage.

From the viewpoint of actors responsible for running the take-back operation, inadequate cleaning of the containers becomes a major loss for inpEV and its affiliates. The system's cost efficiency depends on having access to excellent quality material that can be sold to recyclers at a price that covers the system's high costs (RODRIGUES et al., 2018; YANAGIHARA; BRAGAGNOLO, 2018), which is crucial in light of the complexity of a reverse logistics operation that encompasses all Brazilian regions.

The main pillars in the collection of EACs are inpEV centres, its collection stations as well as an itinerant collection they promote (GODECKE; TOLEDO, 2015; RODRIGUES et al., 2021; WANDSCHEER; CARVALHO, 2016). Leftovers deemed unsuitable for recycling are transferred to incinerators at inpEV's expense. The Campo Limpo System encourages farmers to participate by organizing events known as "Farm Day", when best practices and information are disseminated at agricultural establishments. When it comes to itinerant collections, they are temporary arrangements and focus on regions with poor infrastructure where rural dwellers live with little other means to return EACs. After a few days of service, the collected material is sent to an inpEV's authorized collection points, where they will have an appropriate destination from there.

This research explores the relationship between the volume of EACs that is sold and that are recovered in different states (i.e., federation Units or UFs), their agricultural profiles, and the distribution of collection networks in the Campo Limpo System. Using secondary data and bibliographical references, the article investigates at what point the introduction of EPR policies becomes a limiting factor for the fulfillment of broader sustainable objectives. While most previous work on inpEV and the Campo Limpo System are case studies with a managerial focus (SANTOS et al., 2018) this research aims to obtain a comprehensive understanding of this service, which is currently mature and consolidated in Brazil.

The following section discusses the materials and methods used in the analysis follows. Next, the research results are presented and a discussion based on these observations is carried out. The article ends with the conclusion, references, and annexes.

Material and methods

Databases

The exploratory and descriptive analysis is based on secondary data provided by relevant bodies, with the intent to ascertain farmers' responsibilities within the Campo Limpo System. Initially, it was observed that the Brazilian crop production structure is heterogeneous, even though the expansion of soybean cultivation in the last three decades brought an apparent spatial homogeneity to the Brazilian agricultural landscape (OLIVEIRA; RODRIGUES, 2018, 2020, and 2021). To illustrate this issue, data from the 2017 Agricultural Census carried out by the Brazilian Institute of Geography and Statistics (IBGE) is used.

Although agricultural diversity prevails, the recent advance in the use of agrochemicals has standardized crop management, including family-based Properties (VALADARES et al., 2020). On the other hand, it is difficult to establish a reliable longitudinal dataset on the use of agrochemicals. Only in 2006 was the agricultural census concerned with obtaining this information. In the 2017 census, this aspect became a generic question that does not allow much explanatory depth.

The complexity increases when searching for data about the rate of collection of EACs. InpEV itself recognizes the challenge of making these estimations, although it informs this rate to be at about 90% to 92% per year (INPEV, 2019). The factors that justify these conditions are related to the delay between when the products are purchased and when they are used. It is not uncommon that agrochemicals are applied on crops in the year following their acquisition, if not later. This violates the timeframe for the return of EACs, which is 365 days from acquisition (GODECKE; TOLEDO, 2015). Moreover, the use of illegal products, counterfeited or smuggled products is estimated to be between 20 and 25% of the total volume applied to crops in Brazil (INPEV, 2019).

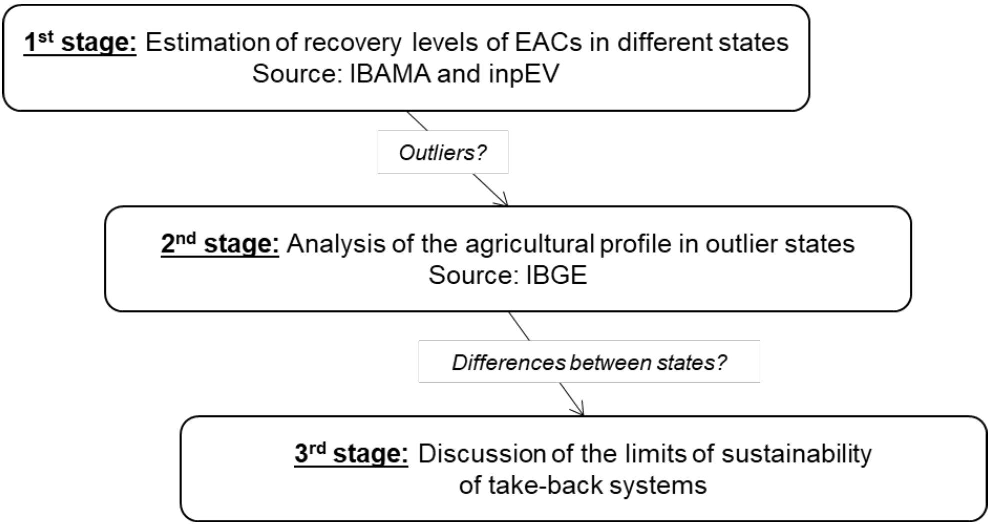
In this context, the number of EACs informed by inpEV on their annual reports are insufficient to understand the Campo Limpo System, from a sustainability viewpoint. To that end, the amount of pesticides commercialized annually in each state was used in the analysis, a piece of data provided by the Brazilian Institute of the Environment and Renewable Resources (IBAMA). However, IBAMA's database suffers from historical irregularities, and thus, only what refers to 2017 (the year of the last Agricultural Census) was used. Moreover, it became necessary to exclude Acre (AC), Amazonas (AM), Amapá (AP), Ceará (CE), Distrito Federal (DF) and Paraíba (PB), since their collection points started the operations only after 2017.

That being said, following data sources have been used in this study: IBGE's Agricultural Census (agricultural information), inpEV's Sustainability Report (collected volume of EACs) and IBAMA's Environmental Database (trade of agrochemicals).

Selection of variables and empirical strategy

The empirical strategy of this study followed three stages, illustrated below:

Figure 1 – Outline of the empirical strategy



Font: Oliveira; Nogueira and Rodrigues (2023).

The inpEV provides information on the collection rate of EACs only at the national level. To measure it at the state level, it is assumed that there is a direct relationship between the volume sold (data from IBAMA) and the volume recovered (data from inpEV). The limitation of this strategy, in addition of ignoring the problem of EACs returned after one year from acquisition has passed, is that the amount of agrochemicals sold is expressed in active ingredients (AI), leading to the complex task of separating what is consumed from what is discarded after use. On the other hand, inpEV's data is expressed in tones (t), that is, only the empty containers that were sent to recycling or incineration. Furthermore, the irregularities of the datasets do not allow for a panel data analysis. Consequently, the study focuses on 2017, when complete information is available.

In addition to these limitations, not all states are considered in the study. With the exclusion of Acre (AC), Amazonas (AM), Amapá (AP), Ceará (CE), Distrito Federal (DF), and Paraíba (PB), the sample became smaller, being inadequate for a more robust statistical analysis. Nonetheless, there are ways to compensate for missing information that results in bias. One way is to outline the extent of these losses. Initially, the high level of data dispersion was denoted through a histogram. These *outliers* require a specific approach (POHLMAN, 2007).

To that end, data were transformed following the mean and the standard deviation of the sample in each parameter as a way to improve the correlation between the variables, in addition to preserving the nature of their distribution. This method allows a comprehensive visualization of the numbers through graphs and induces a comparative calculation between variables. In case there is a performance discrepancy, it is verified that the state in question presented a low level of efficiency in EAC collection.

In order to measure these correlations, a linear regression was used. It assumes that these coverage differences are related to the agricultural structure. However, as related by the Agricultural Census database, there are many variables that portray this production in Brazil. Thus, the ones that are most relevant to the study were selected. At first, the focus lies on a restricted number of cultures. Although tobacco, citrus, cotton, and tomatoes are the main crops on which agrochemicals are employed (PIGNATI et al., 2017), soy has a greater share in the Campo Limpo System than other crops. That is because soy is widely diffused and it is strongly linked to large farmers, making it a key pillar of globalized agribusiness (OLIVEIRA; RODRIGUES, 2020, 2019).

In the Brazilian countryside, most soybean growing regions engage on a practice called "the second crop" or "summer crop", which consists of sowing corn, sunflower or sorghum after the harvest of soy. Therefore, these second crops are included in the analysis. In addition, and in view of their importance for trade, sugar cane, coffee and citrus fruits are also incorporated. These require intense use of pesticides, but are concentrated in certain areas (OLIVEIRA; RODRIGUES, 2019). Other crops of some economic relevance were grouped in "Others" (Table 1).

Table 1 - Variables on agricultural production, broken down by type of farming

Crop	Degree of agrochemical use	Description
Main users (owners of land over 50 ha)		
Soybeans	Medium	Area planted in ha with soy or soy seeds for resale
Second crops	Medium	Area planted in ha with cotton, cotton seeds for resale, sunflower, sunflower seeds for resale, corn, forage corn, corn seeds for resale and sorghum varieties
Sugar cane, coffee, citrus fruits	High	Area planted in ha with sugarcane, forage sugarcane, *arabica* coffee, *collinon* coffee, coffee seedlings, orange, lime, passion fruit, tangerines and citrus seedlings

Other	Medium	Area planted in ha with banana, mango, papaya, watermelon, melon, grapes, grape for wine making, grape seedlings, tomato, white oats, rye, barley, bean varieties, white wheat, dark wheat and wheat seeds for resale
Secondary users (family-owned agricultural properties)		
Grains and seeds	Medium	Area planted in ha with rice, varieties of beans, corn, sunflower, soy and sorgum varieties
Fruits	Low	Area planted in ha with avocado, pineapple. acerola, banana, guava, orange, lime, apple, mango, papaya, passion fruit, watermelon, melon, peach, tangerine, grape and grape for wine making
Vegetables	Very high	Area planted in ha with pumpkin and variations, potatoes, onions and industrial tomatoes
Other	High	Area planted in ha with cotton, sugar cane, arabica coffee, conillon coffee, coconut and yerba mate

Font: Oliveira; Nogueira and Rodrigues (2023).

As a way of capturing agricultural differences among rural producers in Brazil, two groups of consumers were chosen: owners of land over 50 hectares (main users) and family-based farmers (secondary users). Each class is divided according to its productive context (Table 1). In "Family farmers", the groups "Vegetables" and "Grains and Seeds and Fruits" were joined together.

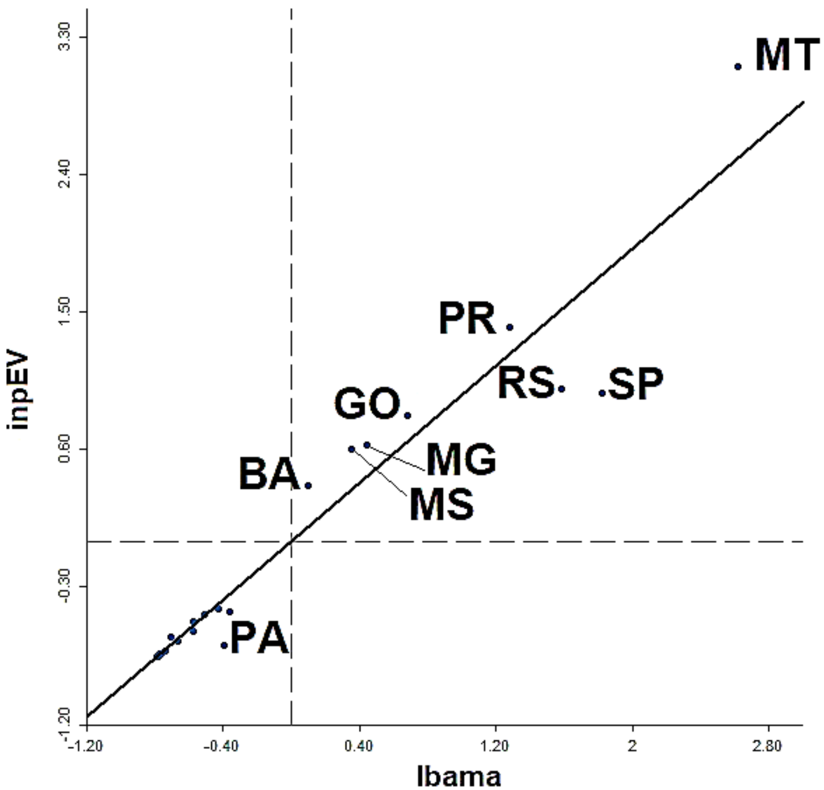
Finally, the analysis is complemented using variables that portray the economic conditions of rural workers provided by the IBGE. It should be remembered that, a priori, farmers with better financial conditions represent lower operating costs for the Campo Limpo System. In this way, the Gini index is a good tool to capture land concentration in each state. The closer to 1, the higher the land accumulation level. Accordingly, rural properties are organized in groups according to their size: very small (below 1 ha), small (1 ha ~ 10 ha), small-medium (10 ha ~ 50 ha), medium (50 ha ~ 100 ha), medium-large (100 ha ~ 500 ha), large (500 ha ~ 1,000 ha) and very large (above 1,000 ha).

In addition to the land issue, other important issues are the level of income, interaction with commercial and industrial networks, given that such conditions are catalysts for rural producers to apply increasing quantities of agrochemicals in their crops (SANTOS et al., 2019).

Results

Although the Campo Limpo System offers benefits for rural producers, evidence suggests that the largest consumers of agrochemicals have a privileged position in the system (Figure 2). By serving the largest consumers, the service can obtain greater efficiency, since this approach allows a high collection rate at an optimized cost, given that this group tends to be geographically concentrated in Brazil. This becomes clear when analyzing the state of Mato Grosso (MT), where the largest demand for agrochemicals can be found, reaching the value of 11.1 tons of EACs collected (INPEV, 2019), while the state with the second largest demand (Paraná-PR) and the third (São Paulo-SP) are far from Mato Grosso.

Figure 2 - Relationship between commercialized volumes (IBAMA) and recovered volumes (inpEV) across Brazilian states in 2017



Font: Oliveira; Nogueira and Rodrigues (2023). Note: R^2 = 0.92

Figure 2 illustrates that Rio Grande do Sul (RS) and São Paulo (SP) are placed below the regression line. Both states have a large number of stations and centers managed by inpEV and partners, but the portion recovered from EACs low in comparison to what is consumed. In the lower quadrant, it can be noted that Pará (PA) has a limited rate of sales and of EACs redeemed by the Campo Limpo System.

The findings that can be seen in Figure 2 point to the existence of regional differences, in terms of the level of coverage of the take back. In some states, there is a strong correlation between the volume sold and recovered (especially MT), others pointing to discrepancy between the variables (RS and SP), and yet others exhibiting weak adherence to the system, with emphasis on Pará (PA). The presence of points outside the curve (MT, RS, SP, and PA) is the starting point for the second stage of analysis: namely, the analysis of their agricultural structures.

Among the outliers, Mato Grosso presents the largest area planted by owners of land over 50 hectares for soybean crops (twice RS, which is in second place) and likewise, for the second or summer crop. However, for other crops, MT is less relevant, especially regarding productions from family farms. The land structure in Mato Grosso is marked by the significant participation of large estates with vast areas used for planting soybeans, which is a differential for the state to supply the recyclers with a high amount of EACs that do go through the triple washing procedure.

The existence of urban hubs where agrochemicals can be purchased such as Rondonópolis-MT and Sorriso-MT (IBGE, 2020) and the installation of an EAC recycler in Cuiabá-MT also collaborated for the state of Mato Grosso to become a reference in the Campo Limpo System (SILVA et al., 2016). A different landscape is found in Rio Grande do Sul, where family farmers have a high representation in the state's agricultural base, especially in the category "grains and seeds". In São Paulo, sugar cane, coffee and citrus are the dominant crops on the state's large properties. Finally, the total cultivated area in Pará is lower than that of the other states (Table 2).

Table 2 - Agricultural production area and its relationship with groups of rural producers (in 1,000 ha)

State	MT	SP	RS	PA
Main consumers (Owners of land larger than 50 ha)				
Soybean	8.870,2	731,3	4.462,9	11,6
Second or summer crops	5.488,5	607,1	486,8	342,9
Sugarcane, coffee and citrus fruits	236,7	5.129,4	5,2	141,1
Others	338,9	217,4	2.061,5	6,7
Secondary consumers (family farmers)				
Grains and seeds	358,0	204,8	1.716,9	79,2
Fruits	9,1	56,9	72,2	20,2

Vegetables	1,1	6,1	12,9	2,1
Outhers	13,8	132,5	166,1	1,7

Font: Oliveira; Nogueira and Rodrigues (2023).

It should be noted that Rio Grande do Sul is particularly strongly represented in "other". In this category, rice farming is the flagship crop in the state, while in family farming, soy is the main crop in "grains and seeds". It was found that the productive structure of Rio Grande do Sul is diversified, where small and large farmers share space. The state's Gini is low (0.427), which indicates a better distribution of land than we can observe in the state of Mato Grosso (0.747). In Mato Grosso, in addition to land concentration, income from the hinterlands is quite high.

On the other hand, the weak presence of commercial and industrial networks in Mato Grosso indicate that the majority of financial gains come from exports of in natura grains, demonstrating the state's strong relationship with the globalized agribusiness. Finally, São Paulo and Pará have similar land structures, but with significant differences in terms of income and the inclusion of farmers in industrial food production networks (Table 3).

Table 3 – Complementary variables

State	MT	SP	RS	PA
Gini (0 – 1)	0.747	0.524	0.427	0.555
Income (thousand R$)	55.067,0	48.926,8	46.630,7	11.930,4
Number of rural establishments that marketed their production through direct sales to consumers (in 1,000 units)	86,9	171,2	298,1	203,7
Number of rural establishments that sold their production for industrial purposes (in 1,000 units)	12,0	45,8	143,5	5,5

Font: Oliveira; Nogueira and Rodrigues (2023).

In view of these results, we find that the determining factor for the efficiency of the Campo Limpo System is its proximity with large rural producers in Brazil, a considerable part of which reside in the state of Mato Grosso. In Rio Grande do Sul, although there is a significant number of authorized inpEV units, the state's heterogeneous profile, characterized by a strong presence of family farming, limits the state's engagement in take-back for EACs. The limited relevance of Pará in the national agricultural scenario, in financial terms, makes its participation in almost insignificant. Finally, the limited participation of farmers in São Paulo requires further studies, but related research suggests that regional aspects play a significant role (MARQUES et al., 2016, 2019).

Based on these findings, the following session discusses the limits of Campo Limpo system as an environmental service in fulfilling its commitments established by Law nº 9074/2000.

Discussions

In addition to the well-known negative environmental and social impacts, EACs also entail challenges to economic efficiency, such as the high operational costs of dealing with items that are returned without having been properly washed (YANAGIHARA; BRAGAGNOLO, 2018). This study demonstrates that the return of EACs is higher in states with predominant soybean production in large properties, than in states with crops known for their high-intensity use of agrochemical products in family properties.

In this sense, despite continued efforts to expand the coverage of the Campo Limpo System, the service relies on large farmers, who are more informed, capitalized, and pressured by inspection (OLIVEIRA et al., 2020). In this way, the participation of small producers is minimized, since by serving the largest landowners in the country, the rate of return of collected EACs can be kept high. On the other hand, there is a risk that, by complying with the letter of the law, deviating from its spirit, structures whose environmental purposes were once ambitious may become nothing more than law-abiding (SAVAGE et al., 2017).

In turn, the methodology adopted in this study does not allow us to state whether the low adherence of small farmers to the Campo Limpo System is the result of purposeful neglect or exclusion or whether it refers to circumstances beyond the reach of the system's coordinators. InpEV does organize itinerant collections exclusively to facilitate the return of EACs. In addition, the inspection of rural properties is the responsibility of competent authorities in the public sector, and not all of them perform satisfactorily (MARQUES et al., 2019). Therefore, in times of incentives for the entry of generic agricultural pesticides, relaxation of environmental laws, and the considerable increase in their consumption in family farms (VALADARES et al., 2020), it is important to note that there is a certain lack of control in the proper disposal of EACs. These episodes are noticeable when analyzing Rio Grande do Sul, a state marked by the high consumption of agrochemicals, including those smuggled from neighboring countries (GODECKE; TOLEDO, 2015), regardless of the group of rural producers under analysis.

At this point, the Campo Limpo System reaches the limit of its sustainability. The service needs properly cleaned EACs for a cost-efficient operation. At the same time, collecting and even recycling empty packaging does not automatically confer sustainability status to the use of pesticides, which are products that pose serious risks to public health and the environment. Furthermore, this type of EAC management can lead to the institutionalization of the use of crop protection products and the legitimization of their growing use. This so-called rebound effect describes the phenomena where a sustainability initiative leads to increased demand for certain materials, while the artifacts recycled from the collected leftovers are insufficient to address such increased demand without additional raw material inputs (ZINK; GEYER, 2017. This situation often happens in efficient take-backs that meet a large demand, whose strong connection between participants creates opportunity costs (FIGGE; THORPE, 2019) and, consequently, decisions that lead to a group of winners and another group of losers throughout the process (HOBSON, 2021).

The degree of complexity of Brazilian agriculture, which seeks to be increasingly competitive in international markets, may contribute to the emergence of a rebound effect in this context. The prominence of agrochemicals not only in farms themselves, but also in the political-institutional scenario inhibits the emergence of agricultural productions that employ little to no agrochemicals. Without space for competition that can challenge the current model medium or long term, farmers are discouraged to abandon of agrochemicals. In view of this, the expansion of the inpEV collection network would only have a marginal effect on addressing sustainability challenges, broadly speaking. However, in states where agricultural expansion is recent, such as Pará, the impact tends to the positive side.

In general, both the legislation and the practical implementation of extended producer responsibility require constant readjustments in order to adapt to new circumstances and previously unknown challenges. This task requires solid engagement on the part of public policy makers, companies and civil society.

Conclusions

This research demonstrated that the Campo Limpo System, an internationally recognized treatment service for EACs, is more favorable to large rural producers in Brazil, most of whom are active participants in the global soy production chain. The study also reported on the implications of this finding to concerns the sustainability of this activity. It was emphasized that the option adopted by inpEV circumvents the problem of the deficient participation of a portion of small farmers in this take back service. Thus, despite limitations in accessing the official database, the information available in reports, as well as the empirical strategy adopted, have been sufficient to discuss the concept of "Extended Producer Responsibility" as an environmental policy.

Once the scope of action of the Campo Limpo System was delimited, the understanding of this theme can be deepened. The introduction of take back for EACs is a complex endeavor with a nationwide scope which is confronted with an opportunity cost. That said, priority has been given to serving large rural producers, which can be understood as a choice related to these actors in the international context. In addition, the lower price of agrochemicals (that can be attributed to the approval of generics) and the lack of an efficient, ecological and healthy substitute for agrochemicals, it can be concluded that the focus on large producers will continue for a long time. Small farmers, devoid of information and financial support, will likely remain at the margins.

For future studies, it is recommended that concept of rebound effect is applied as a way of understanding the limitations of loops in mitigating pollution and waste. This idea, although widespread in Europe, has been little used in Brazilian academic work on take-back systems. Another avenue for further studies is to analyze local solutions that appropriately allocate EACs without the need for centralized coordination. There are international works along these lines (JIN et al., 2018; LAGARDA-LEYVA et al., 2019; MARNASIDIS et al., 2018) which can be a starting point for future research in the Brazilian context.

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Nos limites da sustentabilidade: a responsabilidade estendida do produtor na gestão de embalagens de agroquímicos

Thiago José Arruda de Oliveira
Letícia Antunes Nogueira
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Artigo Original

Resumo: O estudo analisou as limitações na promoção da sustentabilidade no recolhimento de embalagens vazias de agroquímicos. Para tanto, utilizou-se como suporte o Sistema Campo Limpo, dados do inpEV, IBGE, IBAMA e referências bibliográficas. Os resultados apontaram que a coleta de sobras de defensivos agrícolas favorece os grandes produtores rurais, a maioria vinculados à sojicultura, enquanto pequenos produtores se situam marginalizados nessa rede. Embora tal foco permita altas taxas de coleta, os efeitos na agricultura familiar representam uma deficiência importante. Por um lado, take-backs de embalagens de agroquímicos são cruciais para a gestão adequada de resíduos, por outro lado eles podem institucionalizar o uso de agroquímicos e legitimar a sua crescente aplicação. Consequentemente, sustentabilidade na produção de alimentos é um assunto complexo e multidimensional, e exige um esforço conjunto entre a sociedade civil, poder público e produtores.

Palavras-chave: Responsabilidade estendida do produtor; logística reversa; inpEV.

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En los límites de la sostenibilidad: la responsabilidad ampliada del productor en la gestión de los envases de agroquímicos

Thiago José Arruda de Oliveira
Letícia Antunes Nogueira
Waldecy Rodrigues

Resumen: Este estudio analiza las limitaciones de los esquemas de recuperación de envases de agroquímicos para promover la sostenibilidad. A través del caso de inPEV y Sistema Campo Limpo, este estudio concentrarse endatos del IBGE, IBAMA y fuentes secundarias. Los resultados muestran que la organización del sistema favorece a los grandes productores rurales, particularmente en la cadena de la soya, mientras que los pequeños productores son marginados. Si bien este resultado permite altas tasas de recolección, también presenta limitaciones relacionadas con efectos sobre las explotaciones familiares. De este modo los esquemas de recuperación de envases de agroquímicos son necesarios en términos del manejo adecuado de los desechos, pero pueden crear condiciones que institucionalicen el uso de agroquímicos y legitimen un uso más frecuente. En consecuencia, la sostenibilidad de producción de alimentos es un asunto complejo y multidimensional, el cual requiere esfuerzos coordinados de la sociedad, las autoridades y los productores.

Palabras-clave: Responsabilidad ampliada del produtor; logística inversa; inpEV.

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