

COLLECTION OF PACKAGING WASTE FROM PESTICIDES IN THE AREA OF WESTBACKA DISTRICT FROM 2013 TO 2023

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Abstract

With the increase in agricultural areas and more intensive production, the consumption of pesticides also increases. Together with plant protection products, packaging also reaches the market, which after using the products represents packaging waste. Packaging plays an important role in the safe delivery and use of plant protection products, but after use, an efficient packaging waste disposal system should be provided. Packaging waste from plant protection products represents a potential risk to human health and the environment if it is not managed adequately.

Keywords: *pesticide, plant protection, packaging waste from pesticide, risk to human health*

1. INTRODUCTION

Plant protection agents (pesticides) are chemical compounds of organic, inorganic and natural origin that are used to protect plants from diseases, pests and to control weeds. They are used in agriculture, forestry, food industry, veterinary medicine and communal hygiene (Stamenković, S., Milošević, D. 2016). Agricultural production as an intensive production uses large amounts of plant protection products, which in correct and timely application help farmers to achieve good yields of cultivated plants and to produce quality food at an affordable price. Without the application of pesticides, about one-third of the crops were destroyed by disease, infestation or pests.

1.1. Division of pesticides according to purpose

Pesticides are divided according to their purpose, the type of harmful organism they control

- fungicides (agents to combat the causes of mycosis, pseudomycosis and bacteriosis),
- herbicides (means for suppressing harmful weeds),
- insecticides (means for controlling harmful insects)
- acaricides (control mites)
- nematocides (agents for controlling nematodes)
- limacides (snail control agents)
- rodenticides (agents for controlling rodents)
- corvicides (bird control agents)
- repellents (pest repellants)
- attractants (means for attracting insects)
- physiotropes (agents that speed up, slow down or modify physiological processes in plants)
- additional resources (resources for strengthening parts of some resources).

(Stamenković, S., Milošević, D. 2016).

1.2. Content of pesticides (plant protection agents)

A plant protection agent is a finished product in the form in which it is placed on the market - a preparation consisting of an active substance (one or more) and co-formulants, and is intended for use for the purpose of plant protection after dilution with water in a certain ratio;

The active substance is the main ingredient and the main agent of the plant protection agent, that substance that directly acts on the target organism. It is produced as a technical product consisting of a pure active substance and various technical impurities obtained in the production process.

The synthesis of an active substance is a complex chemical process in which an active substance is created from a large number of raw materials in a gradual process that takes place in several stages. This process takes place in several stages, with the presence or absence of a catalyst, oxygen, water and heat.

Technical impurities are unavoidable products of the synthesis of the active substance, and they usually cannot be removed from the active substance, and are part of the finished product. These can be different compounds, and their content in the finished product depends directly on the quality of the raw materials and the quality of the production technology.

Co-formulants are other ingredients that, in addition to the active substance, are included in the composition of preparations such as emulsifiers, thinners, wetting agents, carriers, fillers, antifoams, UV protectants, etc. They ensure optimal preparation (dissolving the preparation in water), application (spraying, sticking to the leaf, uptake into the plant) and action. Without them, the active substance would not be able to achieve its full effect.

The formulation of the preparation is the process of combining (mixing) the active substance and co-formulants into a finished product. Most often, it takes place as simple physical mixing in the case of liquid preparations or as the application of active and auxiliary substances to the carrier in the case of solid formulations (powder or granules).

Formulation type is a term that describes the physical form of a plant protection product. For example, they can be solid: powdery (WP) or granular (WG, DF) or liquid (SC, CS, EC, EW), etc. As a rule, the preparations are dissolved in water before use, except for e.g. granules for direct application.

1.3. Application of pesticides

The label and instructions for use contain text that provides users of plant protection products with all information about the product, the method of application and all measures to be taken both during preparation and application, as well as related to handling the product in all phases, including storage and disposal.

The culture in which the plant protection product is applied is strictly defined in the registration decision. It is prohibited to use the preparation in cultures that are not listed in the solution, regardless of the fact that by analogy the preparation could be used in related cultures. Due to the high cost of registration, preparations are usually only registered for major crops.

The time of application is usually broadly defined, it often relies on the recommendations of the forecasting-reporting service and should include the time when the development of diseases or damage to plants can be prevented by applying the preparation.

The method of application exactly defines the amount of water and the type of application device. These are hard-to-apply rules, since the sprinklers are mostly worn out and the nozzles (sprinklers) are not changed.

The amount of application (dose) specifies the amount of preparation that is applied per unit area of crops/plantations. An excessive amount of the applied preparation is the main potential cause of the appearance of pesticide residues in agricultural products. An increase in the amount can be accidental, when the instructions are poorly read or interpreted or sprayed with faulty equipment. or intentionally, if the farmer doubts the quality and effectiveness of the preparation and inappropriately believes that it will be canceled by increasing the amount without taking into account the consequent increase in residues in agricultural products.

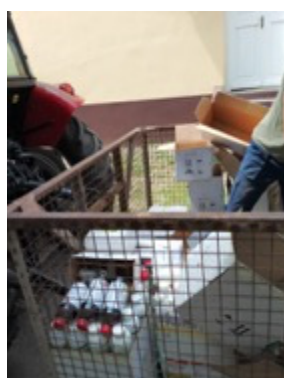
Resistance is a reduced sensitivity of harmful organisms to the preparation, which occurs as a result of an increased amount of application, too frequent use or continuous use of the same preparation. Resistance most often means cross-resistance of organisms to a whole group of preparations that act in

the same way, that is, have the same mechanism of action. Prevention or control of resistance is achieved by using preparations with different mechanisms of action during the growing season.

1.4. How to properly handle empty plant protection packaging?

As long as pesticide residues are not removed from the packaging to a level below 0.1%, it is categorized as hazardous waste that poses a potential risk to human health and the environment. Therefore, it is very important that pesticide residues are removed from the packaging immediately after using the product by washing it as prescribed, and that it is then stored safely and disposed of in the prescribed manner.

Washing enables the removal of product residues, which is very important from the point of view of protecting human health and the environment, but it also has economic importance because it ensures that farmers make maximum use of the equipment they have purchased.



Picture 1. Properly washed and stored packaging

Rinsing of packaging from plant protection products can be carried out:

- Manual – triple rinsing of the packaging
- Mechanical - flushing under pressure/ integrated flushing

In both cases, proper rinsing requires that the pesticide user thoroughly rinse the packaging immediately after emptying and pour the rinse liquid into the sprayer tank.

Manual - triple rinsing involves the following steps:

- When pouring the agent into the sprayer, empty/squeeze the contents of the packaging well
- Fill the packaging with clean water up to 1/3 of the volume and tightly close the cap
- Shake the packaging firmly, rotate, roll so that the water covers all internal surfaces
- Pour the rinsing liquid into the sprinkler
- Procedure described in points 2-4. repeat three times or until the packaging is visibly clean.
- After washing, the packaging should be left upside down to dry
- All the washing liquid should be used for the preparation of the next solution and/or sprayed on the plants.

Mechanical - pressure washing / integrated washing is carried out if mechanical washing equipment is available, it uses water under pressure in the form of a static or rotating sprayer and a valve on a separate hose, or the spraying equipment itself has an integrated element that rinses the packaging. This equipment enables faster rinsing of the packaging with similar efficiency to the triple rinsing procedure, and should be used in accordance with the manufacturer's instructions. The principle of mechanical washing implies that the packaging:

- Rinse thoroughly, for at least 30 seconds or longer, until the rinse fluid is visibly clean;
- Additionally rinse with clean water;
- Drain well, checking if it is clean;
- Place upside down and allow to dry.

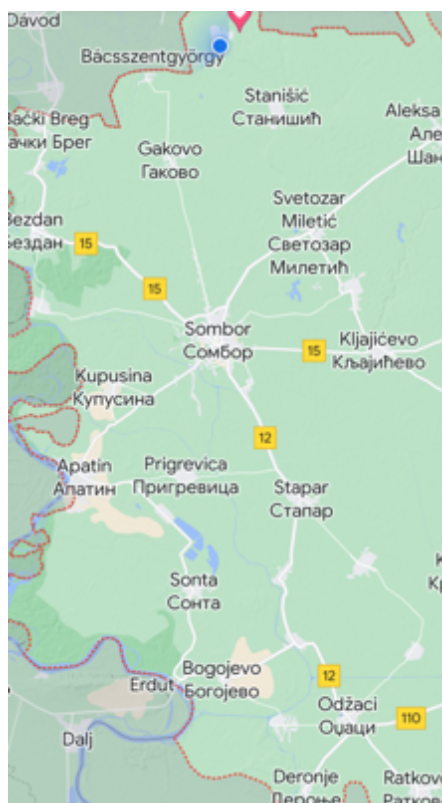
Clean (properly washed) and dry waste packaging can be stored safely on the property out of reach of children and animals, protected from rain, until collection by authorized operators. It is recommended that the re-use of this packaging is prevented by puncturing it and that the bottles and closures are stored separately in appropriate plastic bags. Any other treatment (such as throwing in communal waste, burning in the field or in the open air, burying, throwing in canals, etc.) is not in accordance with the regulations and represents a danger to human health and the environment.



Picture 2 and 3. Improperly disposed (discarded) packaging

In Serbia, the method of disposal of pesticide packaging waste from individual agricultural producers is legally regulated (Law on Packaging and Packaging Waste RS 36/2009-135,95-2018/267), but collection from individual agricultural producers is complicated due to the large number of users and their geographical distribution.

WestBacka district, on the territory of which PSS "Sombor" operates, covers 193796 ha and includes 30 inhabited places.



Picture 4. Map of WestBacka district with all inhabited places

Wanting to help agricultural producers and to raise awareness among them about the proper storage and disposal of packaging waste from plant protection products, PSS "Sombor" started an action to dispose of packaging waste in the area of its operation (municipality of Sombor) in 2013 at the invitation of the organization SECPA, Apatin and Odžaci).

2. MATERIALS AND METHODS

Before the start of the action, agricultural producers were informed through the media (local newspapers, TV, PSS "Sombor" portal, radio) about the exact date of the start of the action. Interested producers were given sacks by PSS "Sombor" and the City of Sombor, in which they disposed of empty used packaging waste. After use, the packaging waste had to be rinsed three times and only then disposed of in sacks. Collection is carried out according to a predetermined schedule, where the exact time of collection is determined for each inhabited place, as well as the place where the waste was collected. In each populated place according to the schedule, the action was controlled by an expert from PSS "Sombor".

Monday - 20.06.2022.	
Rastina	8:00-9:00
Gakovo	9:00-10:00
Ridica	10:30-11:30
Stanišić	12:00-13:00
Svetozar Miletić	13:30-14:30

Table 1. Example of schedule with exact locations and collection times



Picture 5. Removal of collected packaging waste from populated areas by PSS "Sombor"

After collection, this hazardous waste was taken for treatment to an authorized operator for that type of waste. In the period from 2013-2018. agricultural producers from the area of all three municipalities of WestBacka district (Sombor, Apatin, Odžaci municipalities) participated in the action. From 2020 until today, the action was supported by the City of Sombor and the Municipality of Apatin, and the action was carried out only in those areas.



Picture 6. Removal of collected packaging waste from plant protection products by an authorized operator

3. GOAL OF THE WORK

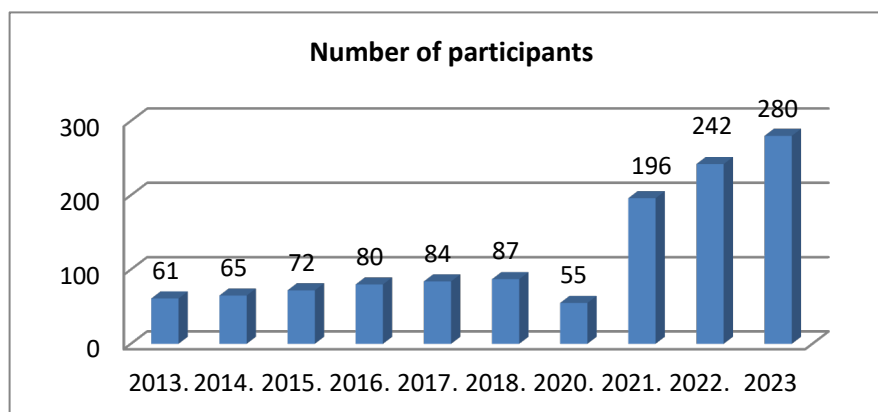
The goal of the project was to establish a system of disposal of packaging waste from plant protection products at individual users in order to reduce the amount of undisposed waste as well as improperly disposed waste by users of plant protection products.



Picture 7. Properly washed and stored packaging

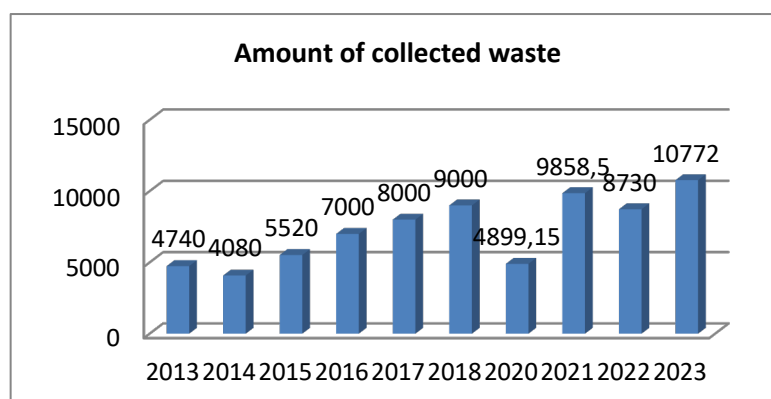
4. RESULTS

When the action started, in 2013, it was implemented in the area of three municipalities (municipalities of Apatin, Odzaci and Sombor) and 61 participants took part. In the period from 2013 to 2018, an increase in the number of participants was registered in the area of these three municipalities, and in 2018, 87 agricultural producers participated in the action. From 2020, the action continued only in the area of the City of Sombor, and 55 agricultural producers participated then, and in 2023, 280 farmers would participate in the action. In the period from 2013-2023. 1222 agricultural producers participated in the action.



Graph 1. Number of participants 2013-2023.

In 2013, 4,740 kg of packaging waste from pesticides was collected, and the amount was increasing so that by 2023, 10,772 kg of packaging waste from plant protection products would be collected. A total of 72,995.5 kg almost 73 t of pesticide packaging waste was collected.



Graph 2. Amount of collected waste 2013.-2023.

If it is known that one empty bottle of 1 l of pesticide weighing about 100 g, then we can say that from 2013-2023. collected more than 720 000 empty bottles.

5. CONCLUSION

When the action started, in 2013, 61 agricultural producers participated in the action and almost 5 t of packaging waste from pesticides were collected. Over the years, the number of agricultural producers who participated in the action increased, so in 2023 the number of producers was 280 and the amount

of collected waste was almost 11 t. In the area of Zapadnobački district, this action "Collection of packaging waste from pesticides" has a tradition and agricultural producers are familiar with it, but this action, as one of the types of good practice, should be continued in the coming years. For now, the action is carried out only once a year (during June), but it is planned to be held in the fall as well in the future.

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