

## WASTE POLLUTION PROBLEM ORIGINATING FROM AGRICULTURAL PRODUCTION

Zorica Mirosavljević<sup>1</sup>, Vladimir Knežević<sup>2</sup>, Bojana Zoraja<sup>1</sup>, Višnja Mihajlović<sup>3</sup>

<sup>1</sup>University of Novi Sad, Faculty of Technical Sciences, Novi Sad, Serbia

<sup>2</sup>RKS kompoziti d.o.o., Čelarevo, Serbia

<sup>3</sup>University of Novi Sad, Technical faculty "Mihajlo Pupin", Zrenjanin, Serbia

e-mail: zoricamirosavljevic@uns.ac.rs

### Abstract

Waste pollution from agricultural production increasingly large proportions every year. Wild dumps are most often on public areas and in watercourses, and the dominant type of waste is that which originates from agriculture. The paper will determine the most common types of waste originating from agriculture, the problems of their disposal and potential solutions for their disposal.

### Introduction

Waste pollution from agricultural production is getting bigger and bigger every year. Wild landfills are most often on public lands and in watercourses, and the dominant type of waste is that left by farmers. The soil is filled with chemicals, and a large number of compounds remain unchanged and reach the human body through food, where they show different effects. Some of the chemicals are extremely toxic, and a large number have been proven to accumulate in the human body and can cause various negative consequences [1], [2], [3].

Today, the use of agricultural land can hardly be imagined without the use of pesticides, herbicides and fungicides. The use of plastics in agriculture represents about 2 % of the over 265 million tons of plastics produced per annum worldwide. This use is globally growing due to an ever more diffusion of intensive and semiintensive agricultural practices [1], [3], [4], [5]. There are almost no alternatives to replacing pesticides in widespread practice and it should be expected that they will be used in the future. Pesticides that are used today are usually of low persistence and their decomposition takes place relatively quickly in the soil. But the mass of their application, with excessive doses, often cause drastic changes in the quality and fertility of the soil.

Also, the irrigation system is a very important item when planning and planting any fruit or any other crop. An irrigation system often requires a lot of money, so people in order to save money resort to seemingly cheaper variants of drip irrigation such as irrigation tapes or hoses with internal drippers. Although these variants are initially cheaper, many manufacturers have convinced themselves over the years that it is better to allocate more money at the beginning for hoses that will last for several years, than to buy cheaper and then buy again every year. Besides being much more cost-effective in the long run, another reason why it's better and smarter to use hoses that can last for years is that in this way we will produce less waste. This abstract aims to highlight the importance of agricultural waste management problems in Serbia with recommendations for solving them.

### Experimental

The cadastre of wild landfills, which served as a guide for identifying the aforementioned problem, showed that they are most often on public areas and in watercourses, and the dominant type of waste is that which originates from agriculture [6].

All agricultural waste can be divided into two types:

1. Hazardous waste: packaging from plant protection products and mineral fertilizers, pharmaceutical waste from animal protection products, waste oils and cooling agents from machinery and waste batteries;
2. Non-hazardous waste: plastic films, watering hoses for greenhouse fittings, protective nets, tires from machinery, harvest residues, biodegradable material.

By reviewing the relevant available literature, the results show that the biggest problem is primarily harvest residues, different types of packaging, worn watering hoses, drip systems, and of course foils. Over time, that waste did not decrease, but on the contrary - it increased and took an ever-increasing share of the total waste. Although years ago both the local self-government and the republic allocated funds for the removal of illegal landfills, unfortunately, they always returned to their old place. It can be seen that most of the emphasis is on plastic originating from agricultural waste.

The established subjects of waste management in Serbia are:

1. Republic of Serbia, local self-government;
2. Environmental Protection Agency, professional organizations;
3. Citizens' associations;
4. Manufacturers and sellers of polluting products;
5. Waste owners;
6. Waste operators.

Operators do not have a developed waste collection network. The local self-government does not have an adequate network of operators for this type of waste. Agricultural pharmacies are generally aware of the problems and are ready to cooperate.

The local self-government has complete competence in the management of non-hazardous waste. There are a large number of small farms and they treat agricultural waste as if it were household waste. They have and use the possibility to leave all the waste on their field or in the yard and do not bear any economic costs, but occupy their plots, which is also not good.

As an example of a good practice of agricultural waste recycling on the territory of Serbia is a company RKS Kompoziti that deal with recycling industrial polymer waste (PP, PE, PVC). Their mission is to give plastic waste second chance and to provide post-consuming life to it. Company goal is to provide simple, quick and economical recycling of industrial plastic waste. Recycling process in this company is divided in several stages: separation, washing, mixing, grinding, agglomeration and regranulation. They obtain products with controlled physical, chemical and mechanical properties. Regranulated product properties can be adjusted according to client's specification and for such products with constant quality. They also, have manufacturing production lines where they use their regranulation products such as PP tape and PP twine. Production capacity in this factory is more than 20 tons per day. Plastic waste used in manufacturing and recycling processes is provided from domestic industry and from foreign suppliers, with whom they have long-term contracts. Their products are available for domestic and foreign markets [7]. An example of collection, scalding and primary shredding of agricultural waste in RKS komoziti is shown in Figure 1.



Figure 1. Collection, scalding and primary shredding of agricultural waste in RKS kompoziti [7]

By interviewing the director of this company, it was determined that the agricultural waste collection network, especially the drip irrigation system in Vojvodina, is a big problem. The company has a contract with some local companies that produce agricultural waste and successfully solve this problem by recycling waste in their plants and making granulate for new use.

The most dangerous solution for agricultural producers is to set fire to production waste, thereby directly endangering their health and the health of people in the area, because plastic materials come from oil derivatives and they are very toxic. When burning plastic, highly toxic substances are released into the air.

The result of pollution is environmental disturbance of local flora and fauna that we do not have to notice immediately, but the effect can last for a very long time, even years in the case of some substances. Proper sorting, collection and reuse (recycling) reduces the amount of waste and saves raw materials and energy.

By noting the present problem and its consequences to the environment in Serbia, which concern the underdeveloped management system for agricultural waste, the paper will further present recommendations for its potential solution based on the example given in the paper [8].

## Results and discussion

Considering that operators in Serbia do not have a developed network for agriculture waste collection, as well as the local self-government that does not have an adequate network of operators for this type of waste, it is recommended to implement the following actions:

### 1. Research initiatives for the management of agricultural waste:

Through research initiatives for the management of agricultural waste it is necessary to determine ways for developing the collection, sampling, and labeling procedures and the methodologies to valorize agricultural waste streams by facilitating their route towards the best waste management alternative.

### 2. Determine the best practices in the field of agricultural waste mapping:

One of the most significant agricultural waste management parameters is the analysis and planning of the collection and disposal of the waste through the implementation of detailed mapping and quantitative characterization of agricultural waste generation (Picuno et al., 2012).

### 3. Analyze aspects of mechanical recycling of agricultural waste, with an emphasis on plastic agriculture waste, as well as the infrastructure employed:

Mechanical recycling is the process of utilizing plastic waste to produce new plastic products [9]. This process's main typical requirements include homogeneity, relatively high purity, and time constancy in the production of the waste flow [10]. [3] established recycling specifications for the agriculture plastic waste. The mechanical recycling process for plastic waste is schematically presented in Figure 2.



**Figure 2.** Stages of mechanical recycling process for plastic waste [8]

By implementing the previous three steps, it is necessary to define the following:

#### 1. Define agricultural waste supply chain:

For the definition of the agricultural waste supply chain, the agricultural waste generation sources must be mapped.

#### 2. Define design of agricultural waste collection system:

The choice of the collection system's design carries great significance since the transportation of the waste from the generation sites dramatically affects the overall energy, environmental, and ultimately the financial costs of the process [11]. This analysis's main objective was to conclude to the most energy-efficient and environmental-friendly scenario, with relation to the transportation of the agricultural waste from the location of the sources to the recycling facilities.

### Conclusion

Regardless of the existing legislation in the field of handling waste materials, as well as appeals related to proper disposal and the possibility of recycling many waste materials, the proper disposal of agricultural waste in Serbia has not taken root. The solution can be to stimulate local operators in order to expand the network and reward those who hand over such waste. An adequate reward and an adequate punishment can lead to the goal the fastest.

### References

- [1] I. Blanco, R. V. Loisi, C. Sica, E. Schettini, G. Vox, *Resources, Conser. & Recyc.*, 137 (2018) 229.
- [2] C. Sica, R.V. Loisi, I. Blanco, E. Schettini, G. Scarascia Mugnozza, G. Vox, *Proceedings of the 43rd International Symposium - Actual Tasks on Agricultural Engineering*. Sveučilište u zagrebu, Agronomski fakultet, zavod za mehanizaciju poljoprivrede, Opatija, Croatia, (2015), 745–754, ISSN 1848-4425.

- [3] D. Briassoulis, E. Babou, M. Hiskakis, G. Scarascia, P. Picuno, D. Guarde, C. Dejean, *Waste Manage. Res.* 31 (12) (2013), 1262–1278.
- [4] Jr. Hemphill, D. Delbert, *HortTechnology* 3 (1993). 70–73.
- [5] P. Picuno, *Polym.-Plast. Technol. Eng.* 53 (10) (2014), pp. 1000–1011.
- [6] Serbian Environmental Protection Agency:  
<http://www.sepa.gov.rs/index.php?menu=9&id=6003&akcija=showAll#a1>
- [7] Company RKS Kompoziti: <http://rkskompoziti.rs/>
- [8] P. Z. Morsink-Georgali, N. Afxentiou, A. Kylili, P. A. Fokaides, *Cleaner Engineering and Technology*, 5 (2021), 100326
- [9] T. Meng, A. M. Klepacka, W. J. Florkowski, K. Braman, *Waste Manag.* 48 (2016)
- [10] G. Scarascia-Mugnozza, P. Picuno, C. Sica, *Proceedings of World Congress Agricultural Engineering for a Better World*. Bonn, Germany (2006)
- [11] E. A. Christoforou, P. A. Fokaides, *Int. J. Green Energy* 12 (2015)