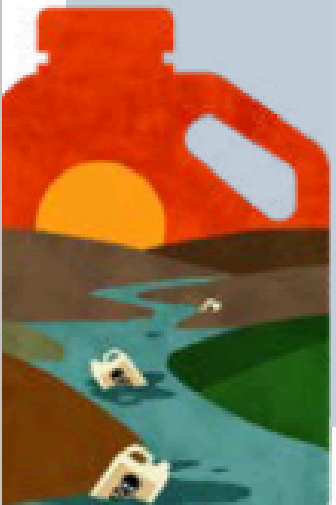
EXTENDED PRODUCER RESPONSIBILITY IN PESTICIDE PACKAGING AND PLASTIC WASTE MANAGEMENT

IN THE KAZDAĞLARI AND EDREMIT BAY REGION

CITIZENS ASSEMBLY

CITIZENS' ASSEMBLY



THE FIELD RESEARCH REPORT

OCTOBER 2023

The Field Research Report on Extended Producer Responsibility in Pesticide Packaging and Plastic Waste Management in the Kazdağları and Edremit Bay Region (October 2023) is a publication of the Yurttaşlık Derneği.

This report, which evaluates the results of the field research carried out between September 2022 and September 2023, was prepared by Orkun Doğan, one of the research partners of Yerküre Local Studies Cooperative.

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Introduction

Today, pesticide packaging waste is a significant pollutant, especially in regions where agricultural production is intensive. These wastes are found in water channels, stream beds, field edges, and waste and excavation sites, alongside other plastic waste. Pesticide containers discarded into the environment contribute to both plastic and chemical pollution, leading to soil and water contamination, and pose risks to public health and food safety. Despite these risks, a well-established, holistic, effective, and sustainable waste management model for pesticide packaging has yet to be implemented in Türkiye. On a local scale, there are isolated practices carried out under the leadership of various institutions.[1] In the Kazdağları and Edremit Gulf region, a highly biodiverse and important agricultural production basin, plastic pollution caused by pesticides is a major problem that negatively affects the natural ecosystem, rural life, and the health of the entire society, especially that of producers.

The "More Responsibility, Less Plastic Project," carried out by Yurttaşlık Derneği (Citizens' Assembly) with the support of the United Nations Development Programme Global Environment Facility (UNDP-GEF), aims to reduce pollution from pesticide packaging and other plastic waste used in agricultural production in the Kazdağları and Edremit Gulf region. The project seeks to create a foundation for extended producer responsibility in order to design and implement an alternative, participatory, and locally grounded waste management model in collaboration with all stakeholders. In establishing the participatory waste management plan envisioned by the project and enabling the implementation of more effective and inclusive practices, the opinions and suggestions of the most critical actors in the waste system—farmers and agricultural pesticide retailers—are of great value. In line with this, a field study involving these actors was planned as part of the project.

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- *Examples of locally implemented projects for the disposal of pesticide packaging waste include; Antalya Metropolitan Municipality, Agricultural Packaging Collection Machines Project(2022)*
- *Muratlı District Directorate of Agriculture and Forestry, Empty Agricultural Pesticide Packaging Collection Project(2014)*
- *Muğla Provincial Directorate of Agriculture and Forestry, Collection and Disposal of Plant Protection Products and Fertilizer Product Agricultural Packaging Waste Project(2022)*
- *Acıpayam Municipality, "AcıpayamMunicipality Collects Pesticide Waste"(2022)*
- *Süleymanpaşa Municipality, "AProject toSeparate Agricultural Waste Has Been Implemented"(2020)*
- *Malkara Municipality, "PesticideWasteCollection Points Established in Rural Neighborhoods"(2018)*
- *İzmir Metropolitan Municipality, "Fertilizer Support Provided to Farmers Who Collect Agricultural Packaging Waste"*
- *Kocaeli Metropolitan Municipality, "Collection and Disposal of Agricultural Pesticide Packaging Waste in Kocaeli Province Project"(2022)*

This field research aims to identify the current situation regarding pesticide use in agricultural production, the disposal of pesticide packaging waste, and plastic pollution caused by pesticides in the Kazdağları and Edremit Gulf region. It seeks to understand the knowledge, awareness, and attitudes of producers and pesticide retailers on these issues and to compile their solution proposals. Accordingly, the field research included a survey conducted with local farmers engaged in agricultural production and semi-structured in-depth interviews with retail dealers who sell pesticide products. The data collected from these interviews enabled an exploratory analysis of the knowledge, awareness, attitudes, and behaviors of farmers and pesticide sellers regarding pesticide use in agriculture and the disposal of pesticide packaging waste. In this way, comprehensive data and analysis were provided for the design of a sustainable, inclusive, and participatory waste management system, which is targeted by the project to reduce pesticide-related plastic pollution.

The report consists of five sections. The first section outlines the background of the project and presents desk research data compiled prior to the fieldwork to inform the research design and offer a general overview of pesticide use and pesticide packaging waste in the region. The second section explains the methodology of the field study. The third section evaluates the results of the farmer surveys, which form the foundation of the research. The fourth section analyzes the in-depth interviews conducted with agricultural pesticide retailers. The final section presents an overall evaluation of the research findings to contribute to other project activities and the development of an alternative waste management model.

October–November 2022, Survey interviews conducted as part of the field.

Source: Research team

Section 1:

Background

Between 2019 and 2022, Yurttaşlık Derneği (Citizens' Assembly) implemented a project titled "The Citizen's Voice in Local and Regional Public Policies" across four water basins neighboring the Sea of Marmara. In the South Marmara Water Basin—covering districts of Çanakkale and Balıkesir located in the Kazdağları and Edremit Gulf region—citizens working on issues related to agriculture and food, and on the implementation of local plans, programs, and actions to address these issues, came together to form a working group. Through consultations conducted within this group, a focused agenda was identified. Accordingly, a series of activities were carried out to define the scope of the problem and identify the relevant actors regarding the intensive and unregulated sale and use of pesticides in agricultural production, as well as the reduction and disposal of pesticide packaging and plastics. During the project period, research was first conducted on the impacts of pesticides on public health and ecology, as well as on the legislation and practices concerning the management of plastic and pesticide packaging waste used in agricultural production. A stakeholder map of the issue was developed, and meetings and workshops were held with relevant actors. In an effort to understand the various dimensions of the issue and to compile examples of good practice, expert-led consultation meetings were organized with the aim of developing a participatory waste management plan and implementation model that could reduce local risks to public health and environmental pollution. In these discussions, it was emphasized that in order to establish a sustainable waste management model for pesticide packaging, it was necessary to analyze current disposal practices and collect observations and recommendations from the field.

To this end, the need for a local-level situation analysis and needs assessment study was identified.[2]

2 *The "Citizen's Voice in Local and Regional Public Policies" project is being carried out by the Citizens' Association.*

The idea of a participatory waste management plan and a field study to provide data for this plan emerged as a result of the aforementioned consultations. Designed to meet this identified need, the field study targets farmers who use and consume pesticide products in the region, as well as the agricultural pesticide retailers from whom these farmers obtain the products. The aim of this research is to gather data on how a more effective waste management system can be developed to reduce pesticide-related plastic pollution, and how the behavioral practices that cause this pollution can be changed.

*From the presentation of the **Çanakkale Provincial Directorate of Agriculture and Forestry**, dated April 11, 2023*

PROJECT BASIN

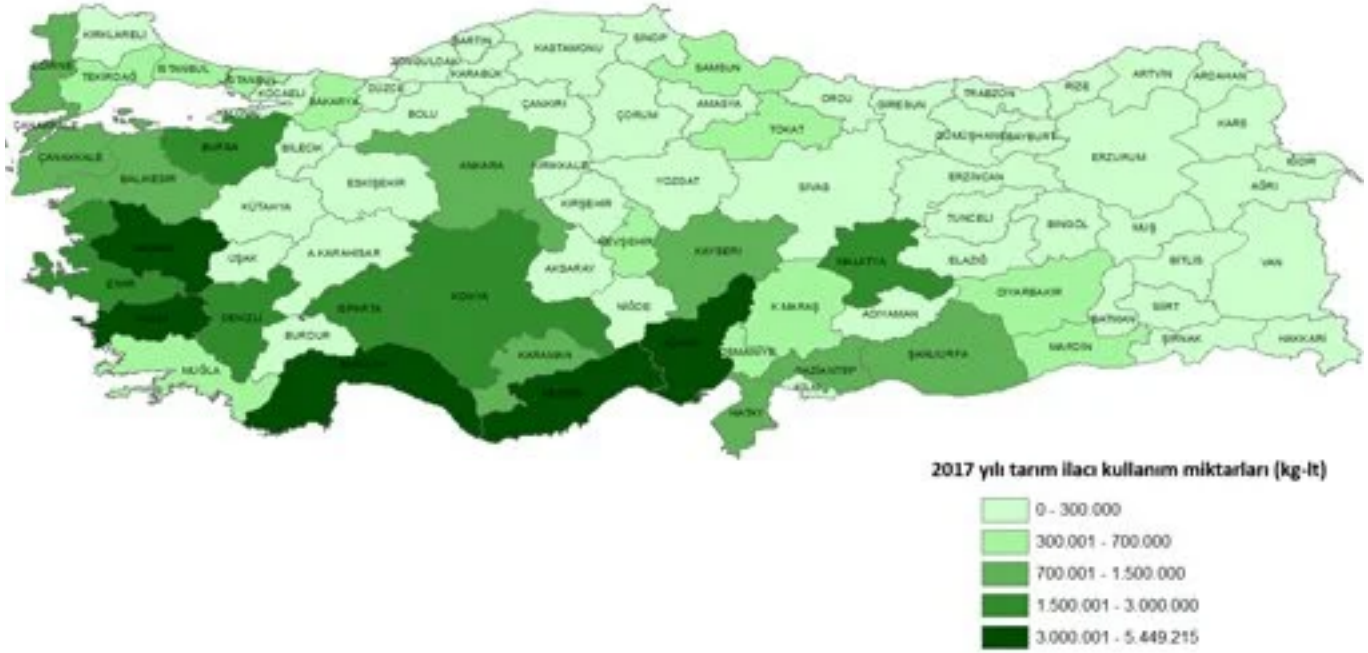
Located within the Marmara Region—the center of urbanization and industry in Türkiye—the South Marmara Region, which includes the provinces of Balıkesir and Çanakkale, remains an area where rural life is still actively sustained. The agriculture and food sectors hold significant importance for the regional economy, both in terms of production value and employment. In this respect, the region functions as a basin that supports and supplies the rest of the Marmara Region as much as possible. According to the 2018 Investment Guide prepared by the South Marmara Development Agency, the region stands out with its wide variety of agricultural products, high agricultural production value and agricultural employment, agricultural infrastructure above the national average, strong potential in organic and good agricultural practices, growing awareness of branding, and diversity of geographically marked products.

An agricultural production and food system that ensures fair access for everyone to healthy and nutritious food must also be ecologically sustainable. Reliable food can only be achieved if the environment in which it is produced—soil, water, and air, in other words, the entire production ecosystem—is clean. From this perspective, although the region possesses significant value and potential due to its demographic, economic structure, and ecology, recent developments such as energy and mining projects, tourism, and urban expansion pose threats to this potential. Another issue that can be considered a risk to the production of healthy and nutritious food in the region is the intensive use of pesticides and pollution caused by pesticide packaging waste.

AMOUNTS OF PESTICIDES USED IN AGRICULTURAL PRODUCTION IN ÇANAKKALE AND BALIKESİR

As part of the desk research conducted during the field study, accessible data on pesticide use and disposal in the region were reviewed to understand the current situation. On the website of the Ministry of Agriculture and Forestry's General Directorate of Food and Control, under the title "Official Agricultural Chemical Statistics," data on plant protection products used in Türkiye by category since 2006 are shared, along with data on the quantities of such products used at the provincial level since 2016. In Figure 1, using provincial-level agricultural land data obtained from the Turkish Statistical Institute's (TÜİK) Crop Production database and 2020 data on plant protection product usage by province, the intensity of plant protection product use (grams per decare) was calculated and visualized on a map of Türkiye. As reflected in the map, the amount of plant protection products used per unit area increases in provinces prominent in agricultural production. A simple inference based on the plant protection product usage intensity data shows that the amount of pesticides used per decare rises in provinces where crop production, greenhouse cultivation, and fruit growing are concentrated. In Çanakkale, where the project is being implemented, 471 grams of plant protection products are used per decare, while in Balıkesir the figure is 239 grams.

Figure 1: *Pesticide Use Intensity by Province (g/decare).*
Source: Ministry of Agriculture and Forestry (2020)



Statistics on the use of plant protection products published by the Ministry of Agriculture and Forestry and data obtained upon request from the Provincial Directorates of Agriculture and Forestry in Çanakkale and Balıkesir, showing the quantities used by province and district, were compiled. Table 1 presents the annual quantities of plant protection products (in kg or liters) used since 2016 in both provinces and their ranking among all provinces in Türkiye in terms of plant protection product usage.

Table 1: Annual quantities of plant protection products used in Çanakkale and Balıkesir and provincial rankings. Source: Ministry of Agriculture and Forestry

Plant Protection Product (kg–lt)	Çanakkale	Balıkesir	TÜRKİYE	The Share of Plant Protection Products (PPPs) Used in Çanakkale and
Year	TR222	TR221	TR	
2016	1.028.441 (14)	757.873 (18)	50.054.000	3,60%
2017	874.408 (16)	1.016.594 (18)	54.098.000	3,50%
2018	1.640.263 (11)	1.018.524 (16)	60.020.000	4,40%
2019	1.348.333 (11)	840.941 (18)	51.297.000	4,30%
2020	1.788.238 (10)	844.441 (18)	53.672.000	4,90%
2021	1589570 (10)	1574663 (11)	52.965.000	6,00%

Within the scope of the project, the Provincial Directorates of Agriculture and Forestry in Çanakkale and Balıkesir were asked to provide data on the amount of plant protection products used by the district over the course of one year. The Balıkesir Provincial Directorate of Agriculture and Forestry shared only province-wide data for 2021, while the Çanakkale Directorate provided district-level data. According to this data, the total amount of pesticides used in the districts of Çanakkale in 2021 is resented in the table below.[3] Based on this table, approximately 1,590 tons of pesticides were used in Çanakkale in 2021. The districts with the highest pesticide use are Merkez (Central), Bayramiç, Biga, and Ezine (Table 2).

3 In the document shared by the Provincial Directorate of Agriculture, both pesticide consumption by type and sales quantities are presented in two separate tables. It has been observed that the total pesticide product sales for the province were calculated based on the sales quantities reported by registered pesticide dealers, and this figure was assumed to be equal to total consumption. Accordingly, the statistics were compiled based on the assumption that all products purchased were consumed within the same year and that no products were obtained or used through unregistered channels. For this reason, the statistic presented as total consumption in the table should be regarded as a lower-bound estimate of actual pesticide use.

Table 2: Sales Quantities of Pesticides Used in the Districts of Çanakkale (2021). Source: Çanakkale Provincial Directorate of Agriculture and Forestry.

ÇANAKKALE İLİ 2021 YILI İÇERİSİNDE KULLANILAN PESTİSİTLERİN İLÇE BAZINDA SATIŞ MİKTARLARI																	
BAYİ ADI	İNSEKTİSİT		FUNGUSİT		HERBİSİT		AKARİSİT		RODENTESİT		DİĞER		TOZ KÜKÜRT	GÖZTAŞI	TOPLAM		GENEL TOPLAM
	KG	LT	KG	LT	KG	LT	KG	LT	KG	LT	KG	LT	KG	KG	KG	LT	KG/LT
MERKEZ	7.777	44.826	83.410	18.654	848	60.631	1.210	5.076	1.120		385	4.328	100.125	43.325	238.200	133.515	371.715
AYVACIK	685	4.510	2.841	1.113	127	4.433	290	1.138	576		30	534	9.500	3.175	17.224	11.728	28.952
BAYRAMİÇ	5.164	30.101	79.085	18.697	812	36.153	3.463	8.216	524		3.262	7.114	98.900	17.760	208.970	100.281	309.251
BİGA	1.460	21.425	6.054	11.802	498	136.631	410	2.201	545		2.946	20.472	33.436	4.290	49.639	192.531	242.170
ÇAN	327	1.911	1.774	1.227	303	11.403	324	263	267		220	545	75.100	2.800	81.115	15.349	96.464
ECEABAT	152	842	1.795	2.001	84	7.907	42	30	237				20.250	125	22.685	10.780	33.465
EZİNE	4.295	15.680	41.633	4.522	5.209	31.293	2.611	4.868	605		5.557	7.348	93.100	6.210	159.220	63.711	222.931
GELİBOLU	768	5.927	6.589	9.314	503	42.689	1.420	753	1.124		110	964	34.150	1.650	46.314	59.647	105.961
LAPSEKİ	5.625	27.117	32.742	19.795	1.651	32.360	1.355	3.320	231		1.870	8.425	6.205	13.495	63.174	91.017	154.191
YENİCE	336	1.272	2.038	1.101	3.577	11.381	170	253	253		13	331	2.065	1.680	10.132	14.338	24.470
TOPLAM	**26.589**	**153.611**	**257.961**	**88.226**	**13.612**	**374.881**	**11.295**	**26.118**	**5.482**	**0**	**14.393**	**50.061**	**472.831**	**94.510**	**896.673**	**692.897**	**1.589.570**

In the provincial environmental status reports prepared annually by the Provincial Directorates of the Ministry of Environment, Urbanization and Climate Change (MoEUCC), the amount of pesticides used in agriculture throughout the year is shared under the heading “Soil Pollution

Resulting from Agricultural Activities.” These amounts are presented in a table that includes "chemical substances used in agriculture other than fertilizers." The data presented for Çanakkale and Balıkesir in these reports are consistent with the figures provided by the Ministry of Agriculture and Forestry. Although the provincial environmental status reports also refer to analyses conducted to detect pesticide accumulation in the soil resulting from pesticide use, both provinces' reports state that “there is no up-to-date information regarding the analysis results.” As a result, no data is shared on possible pesticide accumulation in the soil in either province.[4]

Additionally, the 2022 Assessment Report on Türkiye’s Environmental Issues and Priorities[5] also published by the MoEUCC, includes the quality classifications of surface water, groundwater, and bathing waters by province, as well as the probable sources of pollution. The report examines the data on water pollution in Balıkesir and Çanakkale.

According to the report, no information is available on the status of surface waters in Çanakkale—no data was shared. For Balıkesir, seven rivers classified as surface waters within the province were found to be at the lowest water quality level, and "the use of agricultural chemicals and fertilizers" is listed among the causes of this pollution. No analysis results are shared regarding groundwater for either province. As for bathing waters, both provinces are reported to have high water quality, with no pollution sources mentioned.

4 *Environmental Status Report for Balıkesir Province (2021)*
Environmental Status Report for Çanakkale Province (2021)
5 *Assessment Report on Türkiye’s Environmental Issues and Priorities (2023)*

CURRENT DISPOSAL AND WASTE MANAGEMENT PRACTICES FOR PESTICIDE PACKAGING IN THE PROJECT AREA

The management of agricultural chemical packaging waste, specifically the proper disposal of such waste, poses a significant problem in Çanakkale and Balıkesir—two provinces with intensive agricultural production—as it does across Türkiye. Accordingly, preliminary meetings were held with relevant institutions within the scope of this study to gather information on the efforts and disposal rates of pesticide packaging waste in these two provinces. It was found that a disposal project specifically addressing pesticide packaging waste has been in place in Çanakkale since 2017. In Balıkesir, no such implementation currently exists, although a project is in the planning and design phase.

In Çanakkale, the issue of empty pesticide packaging entered the public agenda in 2015 due to reports in local and national media. Accompanied by striking images, these reports exposed the pollution caused by accumulated pesticide packaging waste in the Bayramiç Dam basin, which supplies both drinking and irrigation water to the Bayramiç district. Following these reports and images, the Çanakkale Governorship took an interest in the matter, and the Provincial Directorate of Agriculture and Forestry and the Provincial Directorate of Environment and Urbanization collected and disposed of the waste. Investigations revealed that intensive pesticide use for plant protection —especially in apple production—was taking place in Bayramiç, and that empty pesticide containers were being carelessly discarded into the environment, streambeds, and irrigation canals. These wastes were found to be carried by rainwater into the Bayramiç Dam Lake, posing threats to human health and causing environmental pollution.[6]

*From the presentation of the **Çanakkale Provincial Directorate of Agriculture and Forestry**, dated April 11, 2023*

6 Milliyet, 2015. *"Pesticide Containers in Bayramiç Dam Raise Concern"*, **Accessed: 12.01.2023**
Demirören Haber Ajansı, 2019. ***"Pesticide Waste Problem Continues in Bayramiç Dam"***, **Accessed: 12.01.2023**

*From the presentation of the **Çanakkale Provincial Directorate of Agriculture and Forestry**, dated April 11, 2023*

In response, the "Project for the Collection and Recycling/Recovery of Agricultural Chemical Waste" was developed in 2017 under the coordination of the Çanakkale Governorship.[7] As part of the project, the Provincial Directorate of Agriculture and Forestry, the Provincial Directorate of Environment and Urbanization, the Çanakkale Special Provincial Administration, relevant municipalities, and village headmen collaborated to designate 17 settlements—13 villages and 4 neighborhoods in Bayramiç—as pilot areas. A total of 275 specially manufactured, leak-proof galvanized containers were installed in appropriate locations across 114 villages. The project aimed to prevent the burial of plant protection product packaging waste in soil, open burning, random disposal into the environment, and their reuse for other purposes. The broader goal was to stop these containers from reaching reservoirs and water bodies, thereby preventing contamination of irrigation and drinking water sources.

Consequently, the project sought to provide cleaner drinking water for local communities, prevent soil pollution caused by pesticide packaging, enhance the quality and market value of agricultural products, and contribute to the national economy through the recycling/recovery of collected packaging waste. The project aimed to prevent the burial of plant protection product packaging waste in soil, open burning, random disposal into the environment, and their reuse for other purposes. The broader goal was to stop these containers from reaching reservoirs and water bodies, thereby preventing contamination of irrigation and drinking water sources. Consequently, the project sought to provide cleaner drinking water for local communities, prevent soil pollution caused by pesticide packaging, enhance the quality and market value of agricultural products, and contribute to the national economy through the recycling/recovery of collected packaging waste.

***7** The project is currently implemented under the title "Project for the Collection and Disposal of Pesticide Waste." While the initial design of the project aimed for recycling and/or recovery of the waste, in practice, the collected materials are now disposed of through incineration.*

The waste disposal method implemented under the project functions as follows: Pesticide packaging waste left by producers in special containers placed in villages with relatively dense agricultural activity and populations is first transported to district-level collection points. From there, the waste is moved to a centralized collection facility in Bayramiç for storage. Finally, a licensed waste disposal company transfers the waste to its facilities in Balıkesir for final disposal.

Initially launched in 2018 in 15 villages and 4 neighborhoods in the Bayramiç district of Çanakkale, the disposal project was expanded to Ezine in 2020, and to the Central district, Biga, and Eceabat in 2021. Although the same administrative unit coordinates the project, it is implemented in each district with different participating institutions and varying financing and budgeting practices. As of today, a total of 269 collection units are operational in 114 villages across five districts in Çanakkale. Since 2018, a total of 21,500 kg of empty agricultural chemical packaging waste has been collected and disposed of.

Table 3: Estimated Annual Pesticide Packaging Disposal Rate

Year	Plant Protection Products Used (kg-lt)	Plastic Packaging Weight (kg) (85%)	Total Packaging Waste Weight (based on 200 gr per unit) (kg)	Pesticide Packaging Disposed under the Project (kg)	Disposal Rate (%)
2018	1.640.263	1.394.224	278.845	2.900	1,0%
2019	1.348.333	1.146.083	229.217	3.300	1,4%
2020	1.788.238	1.520.002	304.000	4.200	1,4%
2021	1.589.570	1.351.135	270.227	6.540	2,4%
2022*	1.591.601	1.352.861	270.572	4.560	1,7%

The disposal project implemented in Çanakkale is significant in that it stands out as a rare example in Türkiye. Despite the absence of detailed regulations on the management of pesticide packaging waste within national waste legislation, the project has been carried out consistently and with an expanding scope for five years, thanks to inter-institutional cooperation and coordination in Çanakkale. This makes it a noteworthy case. However, it is known that the pollution in the Bayramiç Dam caused by pesticide packaging waste —which initially triggered the launch of the disposal project—still persists.In fact, similar images to those that brought the issue to public attention in 2017 resurfaced in media reports in 2021, once again sparking public debate.[8]

8 Hürriyet, 2021. "Bayramiç Dam Threatened by Toxic Pesticide Waste"Accessed: 12.01.2023

While the available evaluations regarding the project include data on the total amount of collected and disposed packaging waste, there is no data on producer participation in the project or on the overall disposal rate, which could serve as a key performance indicator.

As part of this research project, estimations were made based on the annual quantities of plant protection products sold in the province. Assuming that 85% of these products are sold in plastic packaging and that packaging tare weight accounts for 20% of the total product weight, calculations suggest that the pesticide packaging collected and disposed of under the project represents only about 2% of the total packaging waste generated (see Table 3). Despite the expansion of the project's coverage over the years, this percentage has unfortunately shown little change.

In summary, within the scope of the exemplary disposal project implemented in Çanakkale, a total of 21,500 kg of empty pesticide packaging waste has been collected and disposed of over five years. However, when considering the total amount of pesticide packaging waste generated in the province during these years, it is estimated that the proportion of waste actually disposed of remains low and has not shown an upward trend.

Section 2:

Fieldwork and Research Methodology

This field research aims to contribute to the development of an integrated and participatory waste management system for the disposal of pesticide packaging waste, which constitutes a significant dimension of plastic pollution related to agricultural production in the Kazdağları (Mount Ida) and Edremit Gulf region. In this context, the study seeks to assess the knowledge and awareness levels of pesticide retailers, who represent the penultimate stage of the pesticide supply chain, and farmers, who are the end users, regarding pesticides, pesticide applications, and methods of disposing of pesticide packaging waste. Furthermore, the research aims to understand their attitudes and practices concerning the disposal of pesticide packaging waste. The opinions, participation, and suggestions of both farmers and retailers concerning the disposal practices currently implemented in certain districts of Çanakkale are also considered valuable data for the design of an alternative waste management system.

To achieve these aims, a mixed-method research design combining qualitative and quantitative approaches was adopted. Considering that pesticides are subject to much debate in terms of use, disposal, and impacts, it was deemed that the most suitable method for understanding the prevalent views among producers—who are both the final consumers of these products and the group most affected by their potential harms—would be a survey. In addition, as pesticide retailers are the first point of reference for producers regarding plant protection practices, conducting in-depth interviews with them was considered appropriate in order to understand their attitudes towards pesticide use and disposal practices, as well as to determine their potential roles in an alternative waste management model.

During the preparatory phase of the research, preliminary interviews were conducted with representatives of public institutions and farmers to establish the conceptual framework. Information on plant protection, pesticide use, and studies conducted on pesticide and plastic pollution in the region was obtained from the Provincial Directorates of Agriculture and Forestry, the Provincial Directorates of Environment, Urbanization and Climate Change, and municipal authorities. These insights helped shape the scope and boundaries of the research.

Additionally, prior to the fieldwork, a desk study was carried out. Reports and articles on the current state of agricultural production in the region, as well as studies related to plant protection, were examined. Data on pesticide use and disposal practices in the area were compiled. Based on these sources, information was obtained regarding the number of farmers and pesticide retailers at the district level, the leading agricultural products, and the intensity of pesticide use by crop type.

Previous studies on this topic have primarily focused on farmers' knowledge and awareness of pesticides and their behavioral patterns in pesticide use. The few studies that focused on pesticide retailers have generally explored their "professional and knowledge status." However, the literature review revealed no research that simultaneously identified both farmers and pesticide retailers as subjects of study in this specific context. From this perspective, the research has the potential to be a distinctive and pioneering study, aiming not only to gather data on farmers' knowledge and practices regarding pesticide use but also to specifically investigate the disposal of pesticide packaging waste.

Care was taken to select a sample and research method that would reflect the opinions and suggestions of farmers engaged in agricultural production and pesticide retailers in the Kazdağları and Edremit Gulf region.

More specifically, in districts of Çanakkale where the disposal project been implemented, the study examined whether the participation, awareness, and suggestions of farmers residing in villages where packaging waste collection takes place differ from those of farmers in other regions. Finally, by consulting both farmers and retailers on which institutions and actors they consider primarily responsible for pesticide packaging waste disposal and on their views and suggestions regarding the appropriate disposal methods, the study aims to provide valuable data for designing a participatory and ecological pesticide packaging waste management system.

RESEARCH AREA

In selecting the geographical scope of the field study, the activities and work carried out within the basin during the "Citizen's Voice in Local and Regional Public Policies" project were taken as a determining factor. It was decided that it would be meaningful and appropriate to conduct fieldwork in some of the districts where institutions and individuals engaged during this project are located and where the "Collection and Disposal of Pesticide Packaging Waste" project, implemented by the Çanakkale Provincial Directorate of Agriculture and Forestry, is also being carried out. Accordingly, for the farmer survey, the districts of Çanakkale Central, Bayramiç, Ayvacık, Ezine, and Gömeç (Balıkesir) were defined as the geographical scope of the study.

SAMPLING

As part of the preparatory phase, data were collected on the number of villages, village populations, the number of registered farmers in the Farmer Registration System, and technical details regarding the disposal project implemented by the Çanakkale Provincial Directorate of Agriculture and Forestry in the selected districts. Considering the project's timeframe, budget, and feasibility, it was decided that a non-probability sampling method would be most appropriate, specifically a quota sampling approach applied in a convenient manner. Based on conventional statistical methods and representativeness criteria, the minimum sample size was determined to be 370 farmers. Accordingly, the targeted number of survey participants in each district was calculated proportionally, relative to the total number of registered farmers in that district (Table 4).

Table 4: Research Area and Quota Sampling – Targeted Number of Respondents

Districts	Number of Villages / Neighborhoods	Population of Provincial / District	Population of Towns and Villages	Farmers Registered in the	Olive Producers	Target Number of Survey Participants
Merkez	52	184.184	49.706	1.988	1.130	83
Ayvacık	64	33.751	24.408	1.747	1.924	73
Bayramiç	75	29.302	13.659	2.363	1.419	98
Ezine	49	30.723	17.106	2.205	1.888	92
Gömeç	13	16.217	6.000*	1.331	1.000*	55

RESEARCH IMPLEMENTATION

Farmer surveys are methodologically challenging for researchers. Conducting a farmer survey via telephone-assisted or online methods was deemed unsuitable. For this reason, it was decided that the surveys would be carried out face-to-face. Given the wide geographical scope, limited timeframe, and constrained budget, it was considered that the most effective way to reach the targeted number of participants would be to conduct surveys in district marketplaces on market days. However, it was also recognized that relying solely on marketplace interviews might lead to biased results, since farmers selling their products at markets could exhibit distinct attitudes and practices regarding plant protection and disposal methods compared to the general farming population. Therefore, it was decided that surveys should also be conducted in villages. Accordingly, with the exception of Çanakkale Central and Gömeç districts, the surveys were carried out through daily visits that combined both market interviews and village visits. In the Central district and in Gömeç, surveys were conducted randomly with farmers encountered at marketplaces, in the field, and in villages.

To maximize participation in the survey—conducted in marketplaces, fields, and village coffeehouses—and to ensure the collection of meaningful data, the questionnaire was kept concise. The questions were carefully designed to be as clear as possible, avoiding leading or framing effects. The questionnaire was pre-tested through pilot surveys, after which unclear questions were either removed or revised. As a result, a final questionnaire was developed consisting of 5 sections and a total of 25 questions. The estimated time to complete the survey was set at approximately 15 minutes.

SURVEY QUESTIONS AND TERMINOLOGY

Within the scope of the "More Responsibility, Less Plastic Project", this field study focused on pesticides and, more specifically, on the plastic packaging of pesticides. In terms of agricultural production, plant protection, food security and safety, public health, ecological sustainability, and biodiversity, pesticides are at the center of many debates. However, despite the prevalence of these debates, it is undeniable that the level of knowledge and awareness about pesticides—both in society at large and even among farmers who u se them and are most exposed to their effects—remains low.

The Food and Agriculture Organization of the United Nations (FAO) defines pesticides as follows:

"Pesticides are substances intended for preventing, destroying, attracting, repelling, or controlling any pest—including unwanted species of plants or animals—during the production, storage, transportation, distribution, and processing of food, agricultural commodities, or animal feed, or which may be administered to animals to control ectoparasites. The term includes substances intended for use as plant growth regulators, defoliants, desiccants, fruit-thinning agents, or sprout inhibitors, and substances applied to crops before or after harvest to protect them from deterioration during storage and transport. It does not include fertilizers, plant and animal nutrients, food additives, or veterinary medicines."

According to the "Poison-Free Tables" campaign led by the Buğday Association, pesticides are toxic chemical substances used in agricultural production. Based on their functions, pesticides can be classified as insecticides (to kill insects), herbicides (to kill weeds), or fungicides (to kill fungi), and based on their chemical structures, they can be grouped into categories such as organochlorines, organophosphates, or carbamates.

From survey interviews

(*)"Do you use chemical agricultural products to control weeds, pests, or plant diseases in your production process?"

The organizers of this project and the researchers who designed and implemented the field study adopt a position closer to the latter definition of pesticides. However, during interviews with farmers and pesticide retailers, particular attention was paid to ensuring that such positions and perspectives were not emphasized, in order to maintain ethical sensitivity and scientific objectivity.

During the preparation of the questionnaire and interview forms, significant attention was given to how the questions should be asked and which terms should be used. Preliminary interviews with farmers revealed that pesticides are commonly referred to as "agricultural chemicals," "medicine," "poison," "chemical medicine," "weed killer, or "insecticide." Based on this observation, the term most frequently used by farmers, "agricultural chemical" (tarım ilacı), was chosen instead of "pesticide" in the survey forms. In order to prevent confusion with "organic-based plant protection products" used in organic farming (often called "organic medicine"), the term "chemical agricultural chemical" was preferred in the relevant early sections of the questionnaire[*].

FIELD WORKERS AND RESEARCH TRAINING

The planning and implementation of the data collection phase of the field study were carried out under the coordination of Yerküre Local Studies Cooperative, with the contributions and expertise of Çanakkale Local Development Association (ÇAYEKA), students from the Department of Sociology at Çanakkale Onsekiz Mart University, experts from the Gürpınar Sustainable Life Association, and field specialists employed within the GEF project: Pınar Bilir, İsmail Tümay, Müge Okur, and Faruk Özbek.

Within the framework of the defined research method, the planning of field activities, acquisition of necessary permits, and coordination of the fieldwork were organized with the support of ÇAYEKA. The surveys and in-depth interviews w ere primarily conducted by students from the Department of Sociology at Çanakkale Onsekiz Mart University, and were completed with the support of other field specialists and project partners.

The surveys and interviews were carried out by 2nd-, 3rd-, and 4th-year students of sociology who had taken courses on research methods during their studies and who completed field-specific training designed for this project. The students participated voluntarily in this study as part of their summer internships at ÇAYEKA. The field training sessions were delivered by experts from Yerküre Local Studies Cooperative and Assoc. Prof. Dr. Sedat Gündoğdu. The training, conducted face-to-face in a participatory and interactive manner, covered not only general topics such as agricultural production, plant protection, pesticides, and plastic pollution but also focused specifically on survey and in-depth interview techniques tailored to the conditions of the field.

From Enumerator Training

Section 3:

Farmer Surveys and Research Findings

Within the scope of the field study, a survey was conducted between October and December 2022 with farmers engaged in agricultural production in the districts of Çanakkale Central, Bayramiç, Ayvacık, Ezine, and Gömeç (Balıkesir). A total of 624 farmers/producers were interviewed face-to-face. This section primarily presents an analysis based on the data collected from these farmer surveys.

Through market visits and village visits organized as part of the survey, face-to-face interviews were conducted with 624 farmers/producers, of which approximately 40% were carried out during village visits. Considering the villages where the participating farmers carried out their production, the field study was able to cover more than 120 villages in the target districts. Following farmers' participation preferences, pilot surveys, and evaluations of survey responses, 593 completed survey forms were included in the analysis.

From farmer interviews

DEMOGRAPHIC CHARACTERISTICS AND FARM STRUCTURES

It is widely recognized by experts that agricultural production is shaped by a gendered division of labor. Observations from the field study confirmed that this pattern also holds true in the research area. Labor-intensive tasks such as garden maintenance, preparing the land for cultivation, harvesting, and preparing products for sale were predominantly carried out by women, whereas tasks involving the use of machinery and the marketing of products were more often undertaken by men. Thus, it can be argued that agricultural production and marketing in the region follow a gender-based division of labor.

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How plant protection practices are carried out and how responsibilities are divided depend on the type of crop, the scale of production, and the economic capacity of the farming household or enterprise. Therefore, in a study seeking farmers' perspectives on plant protection, pesticide use, and pesticide packaging waste disposal, gender distribution must also be considered. In light of this, care was taken to include women farmers in the interviews. Ultimately, 26.6% of survey participants were women.

The education level of participating farmers reflects the general profile of producers in Türkiye: three out of four had less than a high school education; 17% had completed high school, and 7% held a university or higher education degree. These figures align with the results of the research *"The Farmer's Mind Map"* conducted by Cargill Türkiye in collaboration with Konda Research and Consultancy. **9**

The minimum age among respondents was 18, the maximum was 86, and the average age was 51.3 years. Farmers aged 40 and above accounted for 82.4%, while those below 40—classified as young farmers—made up only 17.6%. No significant difference in average age was observed between respondents surveyed in markets and those surveyed in villages. Although Turkish farmers are often assumed to be younger than their counterparts in the U.S. and Europe, agricultural developments have led to youth disengagement from farming, creating challenges for the continuation of family farms and contributing to an increase in average farmer age. For comparison: The Agricultural Outlook Field Research conducted nationwide by the Credit Bureau of Türkiye (2022) found the average farmer age to be 52.7.**10** The study *"Farmer's Pulse"* by Doktar (2019) reported an average age of 51.**11** Farmers registered in the Farmer Registration System (2020) had an average age of 56, according to the Ministry of Agriculture and Forestry.**12** A Ministry article published in the Turkish Agriculture and Forestry Journal gave this figure as 55.**13**

9. Platinonline (2021). "The Education Level and Internet Usage Among Farmers Is Increasing"
10. Credit Bureau of Türkiye (2022). "Türkiye Agricultural Outlook Field Research"
11. Doktar (2019). "Farmer's Pulse Research Report"
12. Hürriyet (2020). "The Farming Population Is Aging" Accessed: 12.01.2023
13. Hakan Arısoy (2019). "Preventing Migration to Cities Is Possible by Meeting Expectations." Tarım ve Orman Dergisi.

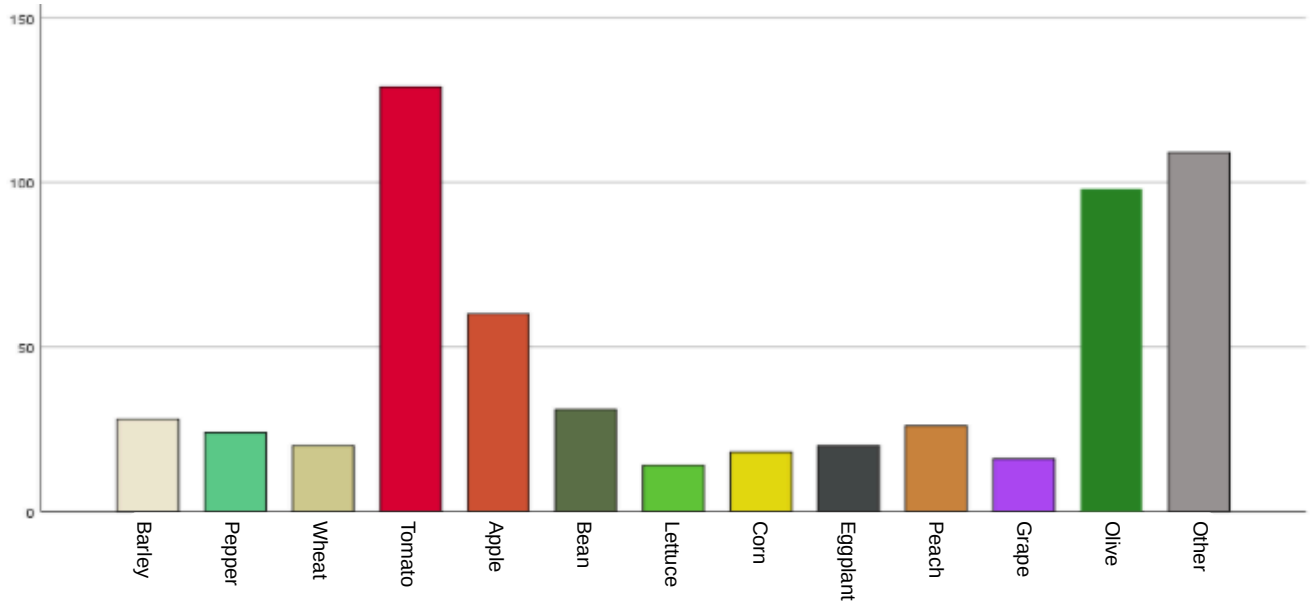
In summary, the average age of the surveyed producers in this study closely matches the national average. Respondents were also asked how long they had been engaged in farming, with results showing an average experience of over 30 years. Nearly all were multi-generational farmers, with farming being their first and only profession. Many participants answered this question with phrases such as *"since my father's/grandfather's time"*, underscoring farming as a family tradition. Respondents with less than 10 years of experience were separately analyzed, revealing that this group had a significantly higher proportion of individuals with high school or higher education compared to others. This suggests that the sample also included newcomers to farming, often more educated individuals who had recently taken up agricultural production.

Preliminary interviews indicated that farm size and type of crop are key factors in pesticide use. Therefore, survey respondents were asked about both the size of their farmland and the primary crops they cultivated (top three products). The average farm size among respondents was 60 decares (approximately 6 hectares). A significant majority (81.7%) reported farming on less than 100 decares of land. According to the "Farm Structure Survey (2016)" published by Turkish Statistical Institute (TÜİK, 2018), 80.7% of agricultural holdings nationwide fall within this category. Thus, the production scale of survey participants can be considered representative of the national average.

FARMERS' CROP PREFERENCES AND SCALE OF PRODUCTION

When assessed in terms of cultivated crops, it is observed that the products grown by the surveyed farmers are consistent with the local climate and are similar to the crops that stand out in the region. Among these, the main crops preferred by a larger number of farmers are shown below in proportion to their frequency. Accordingly, tomatoes, olives, and apples are among the most commonly grown crops in the villages reached through the survey.

Figure 2: *Main crops produced*



In addition, interviews also included questions about organization, practices, and training, which could shape producers' knowledge and attitudes regarding pesticide use and plant protection. Sixty percent of farmers stated that they are not members of any union or cooperative. During the interviews, it was indicated that Provincial/District Directorates of Agriculture and Forestry organize training and extension practices, village meetings, and field visits in order to inform farmers about pesticide use and disposal. To understand farmers' participation in such training and extension practices, respondents were asked whether they had ever attended a training/information session on these issues. Only 18.6% of farmers stated that they had participated in a course or training related to pest control with pesticides. Beyond this, it was found that only 12.1% of participants had experience with production under "Good Agricultural Practices", which were introduced

with the aim of keeping pesticide use under control and conducting plant protection under the supervision of agricultural consultants and agronomists. When participants were asked whether there were special containers in their villages for the collection of pesticide packaging waste, 27.6% stated that such containers existed in their village.

FARMERS' PREFERENCES REGARDING THE USE OR NON-USE OF PESTICIDES IN PLANT PROTECTION

Pesticides have been one of the core components of the transition period called the Green Revolution in the post–World War II global food regime. A productivity-oriented, highly mechanized, input-intensive, and monoculture-based agricultural production system spread globally over time, along with its knowledge base, rules, and institutions, and eventually became today's conventional agricultural production model. At the same time, the increasing frequency and severity of plant and animal diseases due to climate change made pesticides one of the most immediate plant protection methods considered by producers.

However, as input-dependent conventional agriculture became widespread worldwide, pesticides also became the subject of various debates. As medical studies examining the negative impacts of pesticides and their active ingredients on human health grew in number, pesticides came to be questioned in terms of food safety. Additionally, the heavy reliance on chemical inputs triggered a debate on sustainability. Over time, pesticides lost their effectiveness as insects and weeds developed resistance and adapted to new conditions. This gave rise to what has been described as the "pesticide treadmill"—a process characterized by the constant development of new pesticides and the need to apply them in increasing amounts. The widespread and uncontrolled use of pesticides also began to reveal their adverse impacts on biodiversity, bringing the debate into sharper focus. Furthermore, the activities of multinational pesticide producers, processes of market monopolization in agricultural inputs, fluctuations in input and product prices, and the dismantling of public institutions that had conducted research and guided farmers on plant protection issues introduced new dimensions to these debates. All these developments, discussions, and the resulting market rules and institutions shape farmers' attitudes and preferences toward pesticides, their use, and their disposal under their specific conditions.

Figure 3: Reasons stated by farmers for not using pesticides

Within this context, farmers interviewed in the survey were asked a basic question: "Do you apply chemical pesticides for weeds, pests, or plant diseases during production?" 68.3% of the farmers answered yes. This response provides significant data that confirms the observation of widespread pesticide use. The answers also revealed that the likelihood of pesticide use increases with the size of the cultivated area.

Conversely, one out of every three farmers reported not using pesticides. This raises the question: does this reflect a particular attitude among farmers toward pesticides? To explore this further, farmers who stated they did not use pesticides were asked additional questions about alternative pest control methods and their reasons for non-use. Most of the farmers who did not use pesticides reported that they relied solely on physical control methods. When asked about their reasons for non-use, respondents were presented with multiple options and asked to select the ones that applied to them. According to the responses:

- Half of the farmers said they did not use pesticides due to their cost.
- Concerns about health impacts, ecological consequences, and food safety risks also emerged as significant reasons.

This indicates that while concerns about health and the environment do influence farmers' preferences, the most frequently cited reason remains economic cost. Thus, it would be inaccurate to conclude that all non-users categorically reject pesticides based on negative perceptions of their effects. Moreover, 16.3% of non-users stated that they avoided pesticides because they considered them ineffective.

Farmers who reported using pesticides were asked further questions regarding:

- alternative methods they employ besides pesticides,
- pesticide application practices,
- frequency of use, and
- disposal methods.

To assess the extent to which pesticide use was a conscious choice, farmers were asked: *"Do you find chemical pesticides effective in plant protection?"*

Responses showed that there is no clear consensus among pesticide users regarding their effectiveness. Some users considered them effective, while others, despite using them, viewed pesticides as ineffective

Additionally, a significant number of farmers reported that, along with pesticides, they also resorted to physical control methods, preferred resistant varieties, used organic plant protection products, or even prepared and applied their own pesticide mixtures. This demonstrates that farmers are in continuous search of solutions in plant protection. Pesticides, therefore, appear as a compulsory but not definitive solution among these practices.

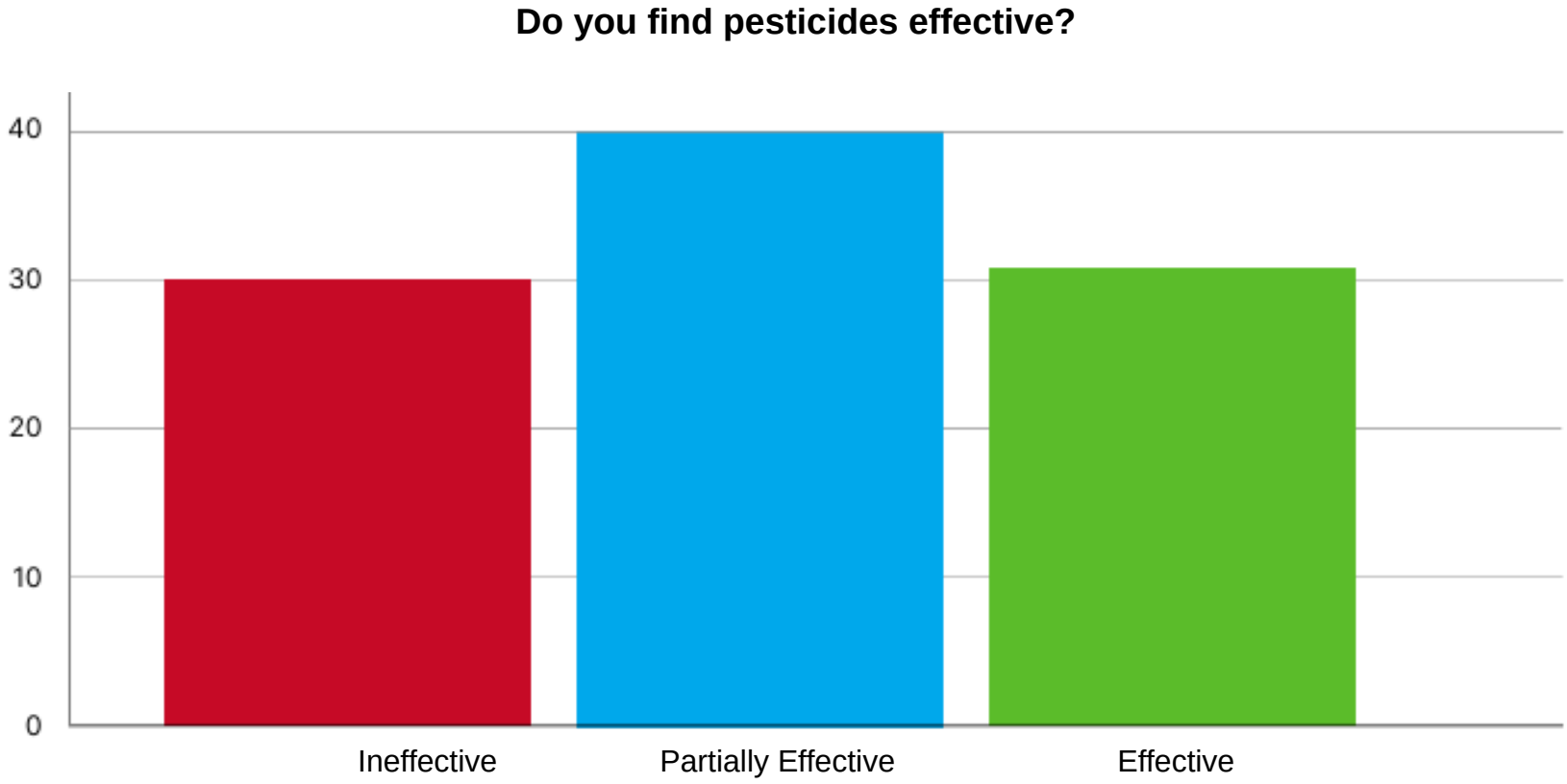


Figure 4: Farmers' views on the effectiveness of pesticides in plant protection

AWARENESS AND CONSCIOUSNESS REGARDING PESTICIDE APPLICATION METHODS

Numerous studies have demonstrated the negative health effects of pesticides, including their impacts on the hormonal system, beginning in the womb and extending into early life.**14** As a result, there are increasing calls for banning pesticides or controlling their use. At the same time, various measures exist to protect individuals from possible harmful health effects when handling pesticides. The instructions for safe pesticide application and necessary precautions are typically indicated on product labels. Agricultural input dealers are responsible for warning and informing customers about these issues, while provincial directorates of agriculture and agricultural chambers also organize training sessions and courses to raise awareness among farmers. Nevertheless, it has been reported that farmers and agricultural workers across Türkiye generally take low levels of precaution to protect themselves against the harmful effects of pesticides (Çelik, 2018).

Table 5: Farmers' awareness of precautions during pesticide application

PRECAUTIONS	Never (%)	Sometimes (%)	Always (%)
I pay attention to weather conditions	1,7	3,5	94,8
I use protective equipment	19,2	15,7	65,2
I keep records	41,1	14,5	44,4
I read product labels	13,2	9,7	77,1
I pay attention to the timing of spraying	7,6	6,9	85,5

14. The information note "Pesticides and Their Effects on Health" published within the scope of the Collaboration for Environment, Climate and Health Project (ÇİSİP), conducted by HEAL (Health and Environment Alliance), HASUDER (Turkish Society of Public Health Specialists), and Kocaeli University Faculty of Medicine, Department of Public Health, sets out the potential health problems caused by pesticides and pesticide exposure.

To assess farmers' level of awareness regarding pesticide application methods, and to examine whether such awareness influences their disposal practices, farmers who declared pesticide use were asked specific questions about their application practices. In this section, respondents were presented with behavioral patterns regarding the precautions to be taken before and during pesticide application, and were asked how often they adopted these practices. Table 5 presents the different precautionary measures and the frequency with which farmers reported adopting them. Key findings include:

- Weather conditions: Almost all farmers reported paying attention to weather conditions, particularly applying pesticides in calm, non-windy conditions, which is one of the most important precautions.
- Protective equipment: Labels on all pesticide products warn against inhalation and skin contact. While protective equipment is sold at agricultural input stores, many farmers also use masks, gloves, or goggles designed for other purposes to avoid direct contact. Strikingly, 20% of farmers answered *"I never use protective equipment."*

- Reading labels: The majority of farmers stated that they read the labels of pesticide products, which indicates that farmers are actively seeking information and are open to guidance on protective measures.- Timing of application: Timing is critical both for effectiveness and for minimizing pesticide residues before harvest. Most farmers reported paying attention to application timing.

- Record-keeping: One of the most emphasized points in plant protection training is the need for farmers to keep records to prevent excessive or incorrect pesticide use. However, responses revealed that record-keeping was the least adopted practice. Fewer than half of the farmers stated that they kept records of the type of pesticide used and the timing of application.

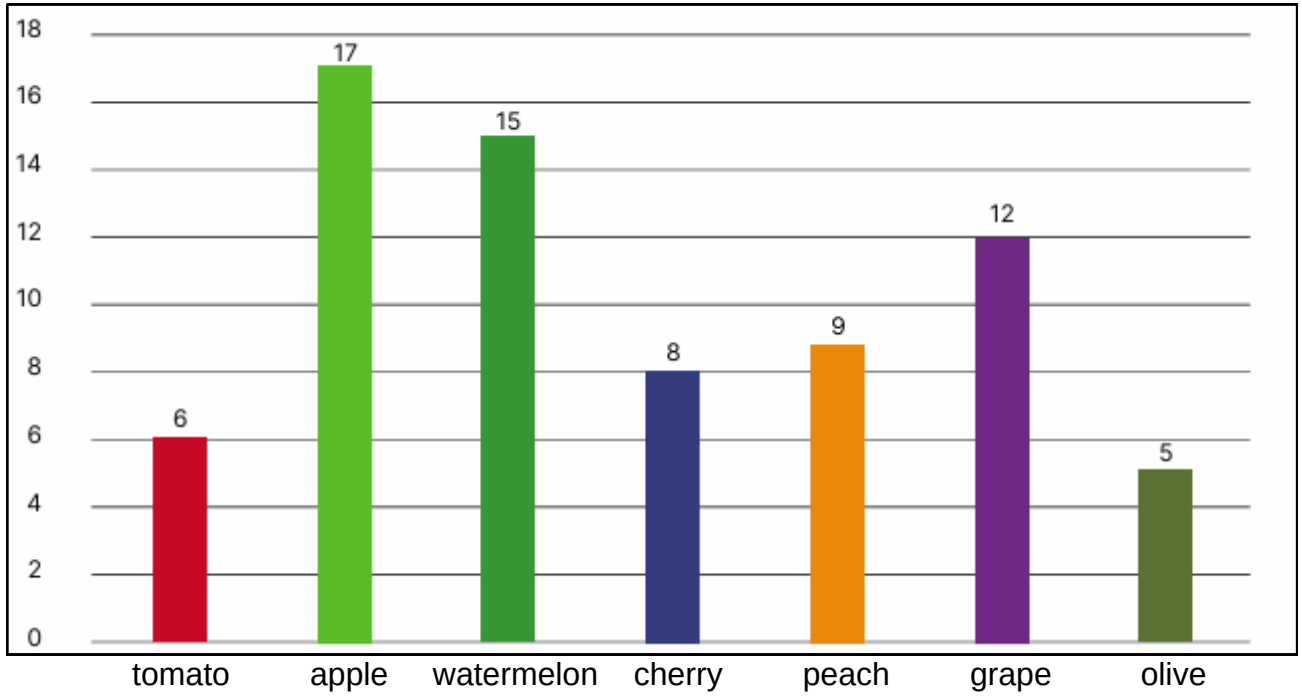
Pesticide packaging collection point and triple Washing practice

NUMBER OF PESTICIDE APPLICATIONS BY CROP

Farmers were asked how many times they apply pesticides during a production season for their primary or most important crop. This was asked as an open-ended question, and the initial responses of farmers were recorded. A significant number of producers stated that the number of applications varies depending on the season and the condition of the crop. Farmers who initially avoided giving a direct number and said it depends on seasonal conditions were asked, if possible, to provide an approximate seasonal average. Farmers' main crops were matched with their responses, and the average number of pesticide applications per season was calculated for each crop. Figure 5 shows the average number of pesticide applications by the most widely cultivated crops in the region.

When all responses are taken into account, it was found that a pesticide-using farmer in the production basin applies pesticides on average 7 times a year. However, this average differs significantly by crop. For instance, the highest frequency of pesticide use was found in apples, with an average of 17 applications per season, followed by watermelon (15), grapes (12), tomatoes (6), and olives (5). These figures, which may appear surprising or even exaggerated to those not closely familiar with agricultural production, were found to be accurate by agronomists working at the Provincial Directorate of Agriculture and Forestry, who organize training sessions and conduct field and orchard visits. In fact, during interviews, it was noted that the calculated average for tomatoes might even be an underestimation, as tomato producers have recently been forced to increase pesticide applications due to the growing prevalence of the tomato leafminer pest in the region.**15**

15. Çanakkale Olay Gazetesi, 2017. "Çanakkale'de Tuta Teyakkuzu", Erişim tarihi: 16 Mart 2023. Çanakkale İl Tarım ve Orman Müdürlüğü. "Çanakkale'de domates güvesine (tuta absoluta) karşı biyoteknik mücadele", Erişim tarihi: 16 Mart 2023.



SOURCES OF INFORMATION AND SUPPLY CHANNELS FOR PESTICIDES

In preliminary interviews with farmers, it was noted that particularly those producing for the market reported being compelled to use pesticides more frequently against the increasing number of plant diseases and pests. However, they also face greater uncertainty and risk due to both extreme weather events and plant health issues. Farmers stated that under these uncertainties and risks, they aim to secure their livelihoods and increase income by growing the maximum yield at the right time.

At various stages of production—such as crop selection, land preparation, planting, maintenance, pest control, and harvesting—farmers are forced to make countless difficult choices that ultimately determine the quantity and quality of their harvest, and therefore their expected income. Pest control and pesticide application are only one of these difficult decisions. It became evident that farmers, in an environment where the state's guiding role in agriculture is diminishing and where professional or economic organizations are weak or ineffective, are in need of guidance and support when making such difficult decisions.

One dimension of the increasing marketization dynamics in agriculture is related to agricultural inputs and pest control. Farmers shape their attitudes and make choices about pest control and pesticide use largely under the guidance of market actors—especially pesticide retailers (agrochemical dealers), and indirectly, pesticide-producing companies—along with their own personal experiences.

Information on which sources/institutions farmers rely on for knowledge about pesticides and their application methods, and through which channels they primarily procure pesticide products, provides important insight into how a participatory waste management plan regarding pesticide packaging waste should be designed and who should be involved. Building on this, the following questions were asked to farmers:

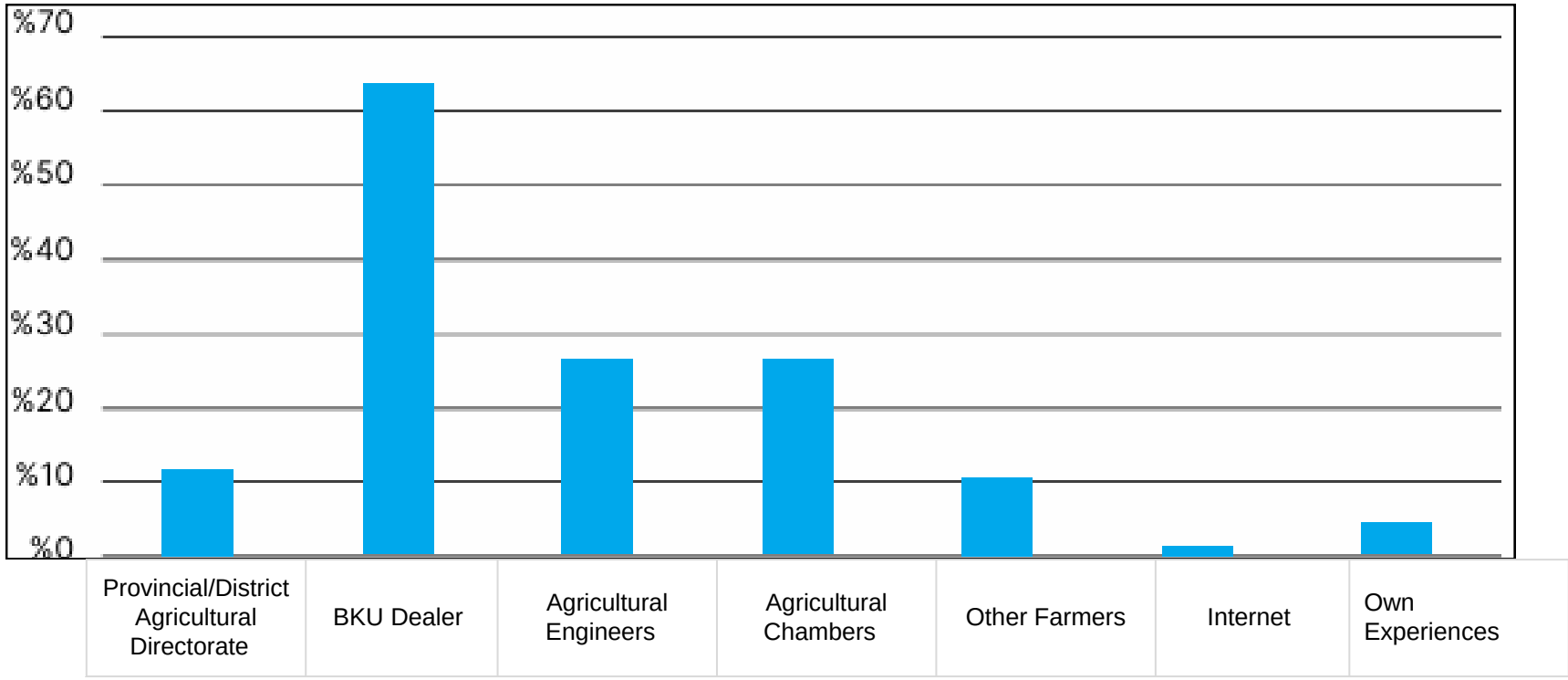
"When choosing the agricultural pesticide you use, and in deciding how much and when to apply it, which sources do you primarily rely on?"

"Where do you primarily purchase the products you use?"

Farmers' own answers were recorded, and when no answer was given, possible options were suggested to prompt them to identify the most relevant choice.

Farmers who stated that they use pesticides reported that they primarily direct their questions about which product to choose, and how and when to apply it, to pesticide retailers (agrochemical dealers) (Figure 6).

Figure 6: Sources farmers rely on for information about pesticides



Two out of every three surveyed farmers who use pesticides said they receive the guidance they need from these dealers. The fact that agricultural chambers and the provincial directorates of agriculture rank far behind dealers as sources of knowledge indicates that public institutions and professional organizations such as agricultural chambers are not sufficiently effective in guiding farmers. When asked where they purchase pesticide products, almost all farmers reported that they obtain them from pesticide retailers. In preliminary interviews, it was also noted that producer associations, cooperatives, and in some districts agricultural chambers sell pesticide products either to their members or to all farmers. A total of 27.4% of pesticide-using farmers indicated these institutions as additional supply sources. The responses to these two questions suggest that, in any participatory waste management plan aimed at tackling pesticide-related plastic pollution and fostering behavioral change among farmers, the active involvement and engagement of pesticide retailers will be essential.

PESTICIDE PACKAGING AND DISPOSAL

Pesticide packaging waste falls into the category of hazardous waste.**16** For pesticide packaging waste to be eligible for recycling, it must no longer retain hazardous waste status, which requires that the residues of active substances remaining in the packaging be diluted to negligible amounts. For this reason, it is recommended that pesticide containers be rinsed three times with water after they are emptied before being disposed of. To understand how widely this knowledge is known among producers, they were asked whether they rinse pesticide containers after use. Half of the farmers who reported using pesticides stated that they always rinse empty containers, while the other half said that they never do. Of those who reported rinsing, half (representing 22% of all survey participants) stated that they wash the empty containers either three times as recommended or by rinsing them with pressurized water.

Observations made during fieldwork, as well as a review of media coverage on the subject, revealed that plastic pollution from pesticide waste is a problem in the region and that the issue has periodically attracted public attention. As in other agricultural basins with intensive production, pesticide packaging waste is often disposed of haphazardly—thrown into fields, nearby water channels, and riverbeds; buried in the soil; burned in the field; or discarded together with other household waste. Some interviewees also mentioned that pesticide containers are sometimes reused for other purposes or collected by waste pickers and fed into the recycling stream together with other packaging waste.

To gather information on the fate of pesticide packaging waste in the basin, farmers were asked about their disposal practices as well as their observations of others' behaviors. Two different questions were posed on this topic. First, farmers were asked in an open-ended format what they do with empty pesticide containers once the product is used up. Next, they were asked about the fate of used pesticide containers in their surroundings, and were presented with a set of common disposal practices as options, from which they were asked to select those that they observed most frequently. Among the reported practices, burning pesticide packaging waste emerged as the most common.

16.

According to the "Waste Management Regulation" enacted by the Ministry of Environment, Urbanization and Climate Change on April 2, 2015, hazardous wastes are defined as those that possess one or more of the hazardous characteristics listed in Annex-3/A, or those marked with an asterisk (*) next to their six-digit waste code in Annex-4. The hazardous characteristics listed in Annex-3/A are described as follows: H4 irritant, H5 harmful, H6 toxic, and H7 carcinogenic. Pesticide waste is also classified in Annex-4 of the regulation (under code 150110) as "Packaging waste (A) containing residues of hazardous substances or contaminated with hazardous substances." As with all substances listed in Annex-4, pesticide waste must also be disposed of in accordance with the same regulation.

Image of a pesticide packaging collection container

According to the farmers, this practice typically occurs as follows: empty containers from pesticides used during the season are usually accumulated in the field. Once they occupy a certain space, they are burned together with other organic agricultural residues in a designated part of the field. Some interviewees further explained that, particularly in fruit-growing, farmers intentionally burn pesticide packaging waste and other plastics in the field during periods of frost risk in order to protect fruit from frost damage. It was also reported that some farmers or agricultural workers burn pesticide containers in the fields during the winter months simply for heating purposes.

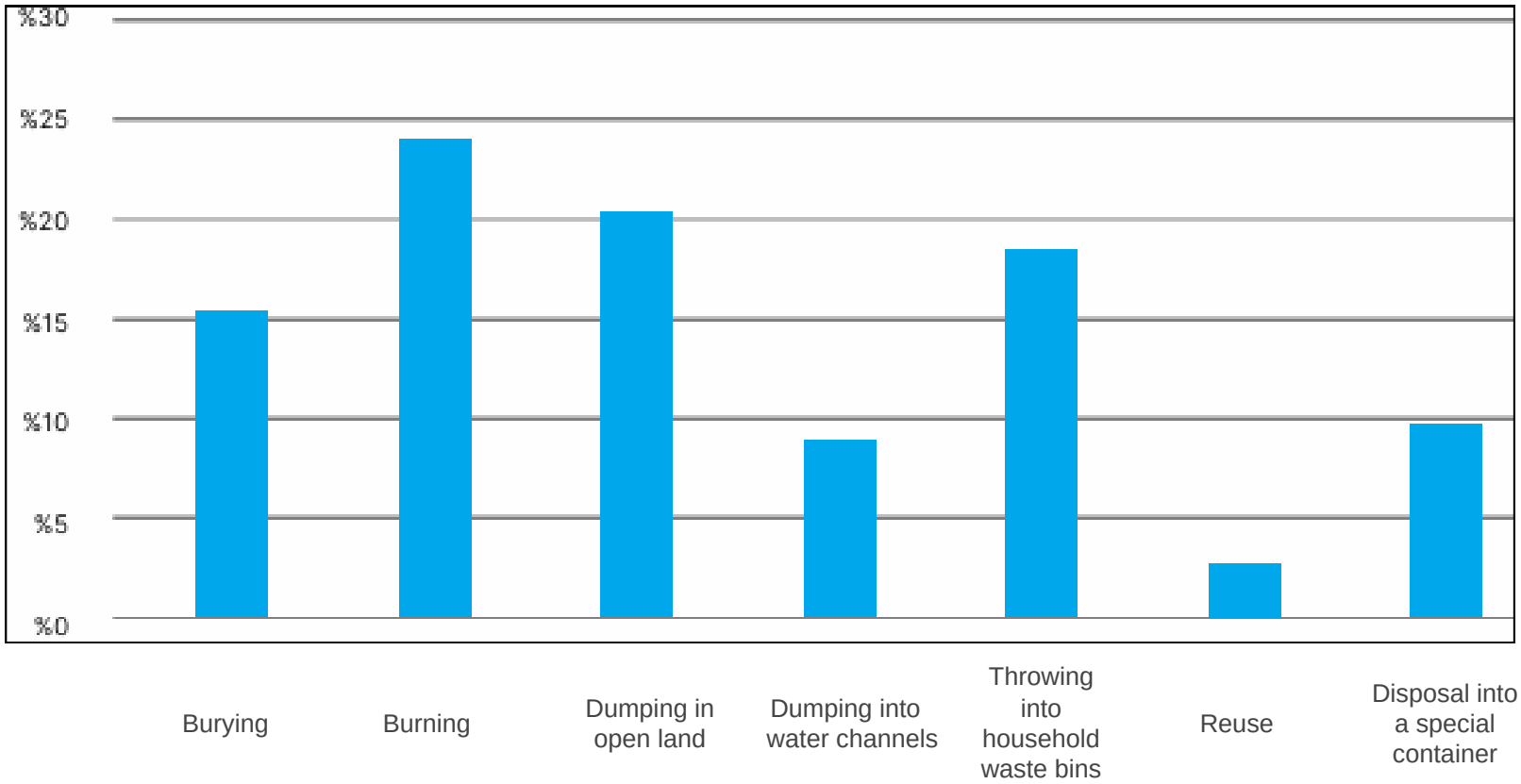
According to the farmers' responses, after burning, the most common disposal methods include dumping the remaining waste randomly in fields and the surrounding environment, discarding it with household waste, burying it in the soil, or throwing it into water channels and riverbeds. Reuse was found to be the least common method. However, some farmers did mention that empty pesticide containers are occasionally reused for other purposes. Another disposal option presented to the farmers was the use of special containers installed in some villages within the research area as part of a project implemented by the Çanakkale Provincial Directorate of Agriculture and Forestry, designed for the collection of pesticide packaging waste. While this option was not considered a feasible method for farmers in villages without access to such containers, it was still included among the alternatives so that participants could indicate whether they personally used this method or observed it being used by others.

A comparison of farmers' responses regarding their own disposal practices and their observations of others' behaviors reveals an interesting pattern. Farmers tended to select fewer options when describing their own practices, but when reporting what they observed other farmers doing, they chose a wider range of practices. This may suggest that their own chosen method of disposal is not necessarily preferred but rather an option adopted out of necessity. Farmers also expressed the view that pollution in their surroundings is partly the result of other farmers' careless, "unconscious," or easy-way-out practices.

Taken together with the open-ended responses and general comments, the findings indicate that farmers are aware that these disposal practices cause pollution and negatively impact both the environment and human health. Farmers often describe their need to dispose of pesticide packaging in environmentally harmful ways as a matter of necessity. Many farmers are aware of the environmental pollution caused by pesticide packaging waste and believe that solutions need to be developed. Importantly, they also point out that farmers themselves must play a key role in these solutions.

Incorrect usage of containers

Figure 7: Disposal methods most frequently used by producers



The disposal practices adopted by farmers and the presence of containers in villages for pesticide packaging waste have been examined through cross-tabulations. Accordingly, the availability of containers for collecting pesticide packaging waste in villages or in areas close to farmland affects farmers' disposal preferences. It has been observed that the presence of such containers significantly reduces the frequency of farmers burning pesticide packaging waste, discarding it randomly in nature, or throwing it into household waste. Farmers participate in the special container project and prefer this disposal method over other polluting practices. This finding indicates that when alternative systems such as special containers are in place, pesticide packaging can be collected in appropriate facilities instead of being discarded into nature, buried, burned, or mixed with other waste, and that farmers are open to cooperation in waste management and willing to participate in such alternative practices.

T**able 6:** Disposal practices applied by farmers depending on the availability of a special container

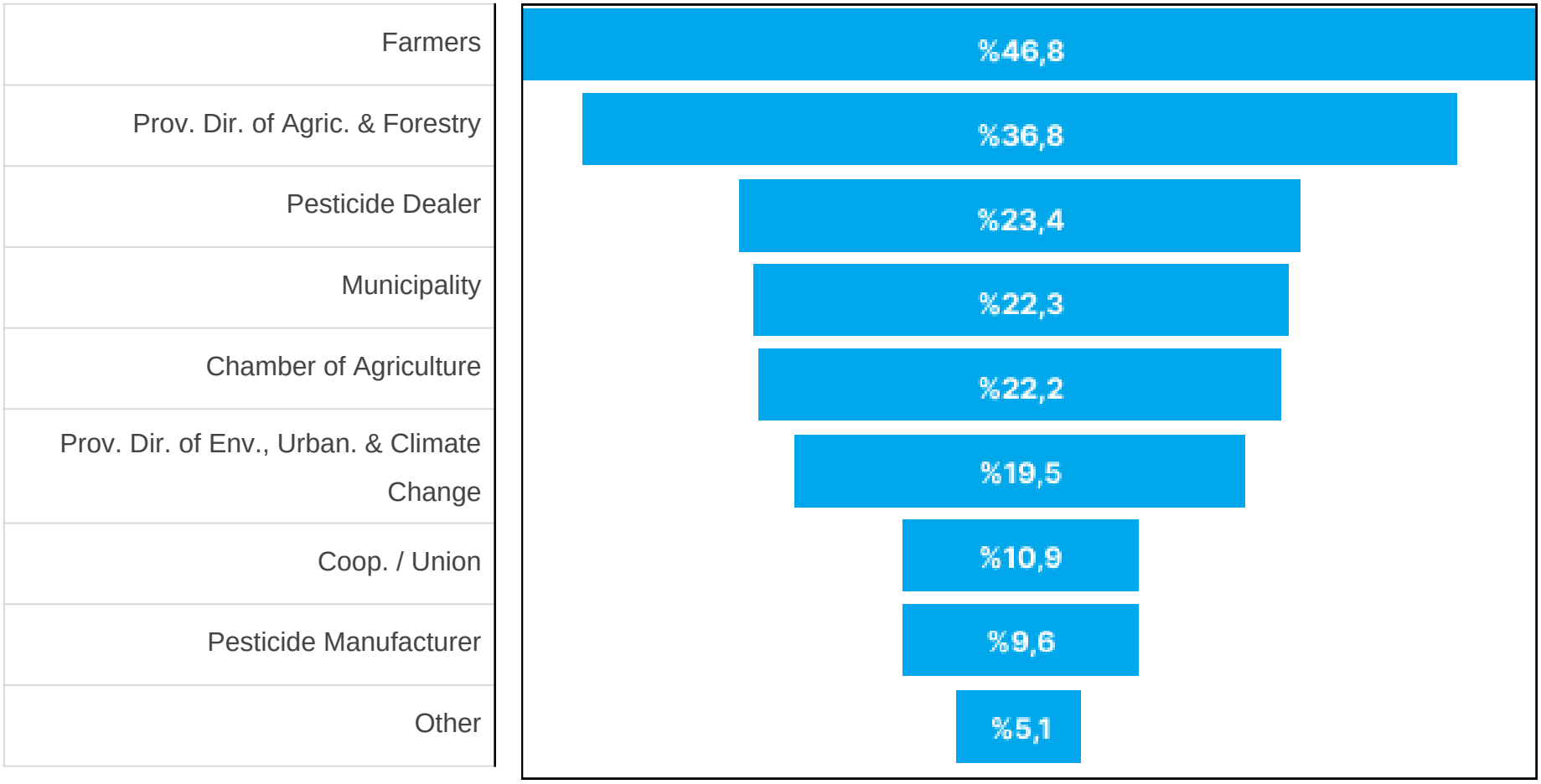
Disposal	Observation and rate within disposal practices	Special container		TOTAL
		Not available	Available	
Burying	Observation	27	8	35
	%	77,10%	22,90%	
Burning	Observation	94	31	125
	%	75,20%	24,80%	
Dumping in open land	Observation	29	15	44
	%	65,90%	34,10%	
Dumping into water channels	Observation	12	2	14
	%	85,70%	14,30%	
Throwing into household waste bins	Observation	68	27	95
	%	71,60%	28,40%	
Reuse	Observation	10	4	14
	%	71,40%	28,60%	
Disposal into a special container	Observation	5	97	102
	%	4,90%	95,10%	
Total responses	Observation	245	184	429

Many farmers are aware of pesticide-related plastic pollution. Moreover, a significant proportion of those who are aware also acknowledge their own role in the emergence of this problem. So, what do they think about possible solutions to this issue? Among the various waste management practices implemented in different contexts, which do they consider more suitable and effective?

Which actors do they believe should take more responsibility in solving the problem? At the end of the survey interviews with farmers, these questions were also addressed.

By reviewing relevant waste regulations and best practice examples, a set of potential actors—those who currently bear or should bear responsibilities in a participatory waste management model centered on pesticide packaging—were presented to farmers as options. Farmers were then asked which of these actors should assume responsibility.

Figure 8: Prominent actors in addressing the problem of pesticide-based plastic pollution

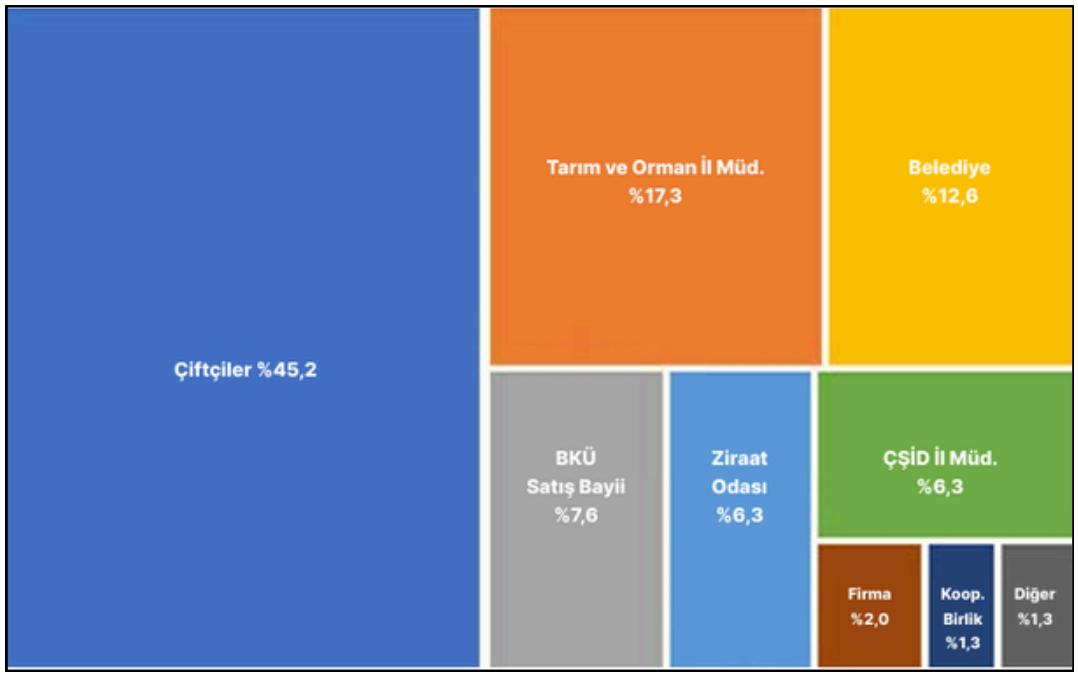


The suggested actors included farmers themselves as waste producers, public institutions with legal responsibilities and ongoing local work in this area, professional and economic organizations to which farmers belong, local administrations, pesticide-producing companies, and retailers of plant protection products. Farmers were also invited to indicate any other relevant actors they deemed responsible beyond the listed ones.

It was found that, just as they recognize their role in the creation of the problem, farmers also attribute the greatest responsibility for solving it to themselves. Regardless of whether they apply pesticides or not, or the scale and type of their production, nearly half of the respondents pointed first to themselves as those who should assume responsibility before other actors. Following this, farmers indicated that the Provincial Directorate of Agriculture and Forestry, pesticide retailers, municipalities, the Chamber of Agriculture, the Provincial Directorate of Environment, Urbanization, and Climate Change, cooperatives and producer unions, and finally pesticide-producing companies should take responsibility in addressing the problem. Additionally, some farmers suggested public administrative bodies such as village heads (*muhtar*), district governorates, provincial governorates, and provincial special administrations, even though these were not listed among the primary options.

Those who pointed to only one actor among the possible options were analyzed separately to identify which actor was prioritized most. Approximately half of the respondents identified a single actor. In this regard, farmers primarily pointed again to themselves, their colleagues, peers, and neighbors as both the cause of and the solution to the problem. Farmer organizations such as chambers of agriculture, cooperatives, and producer unions were not seen by farmers as priority actors in solving the problem. On the other hand, when considering the number of actors identified by the same participant, about half of the respondents indicated that two or more actors should take responsibility. This suggests that the issue itself, as well as any potential alternative waste management model, should be designed as a participatory system in which all these actors are included within clearly defined roles and responsibilities.

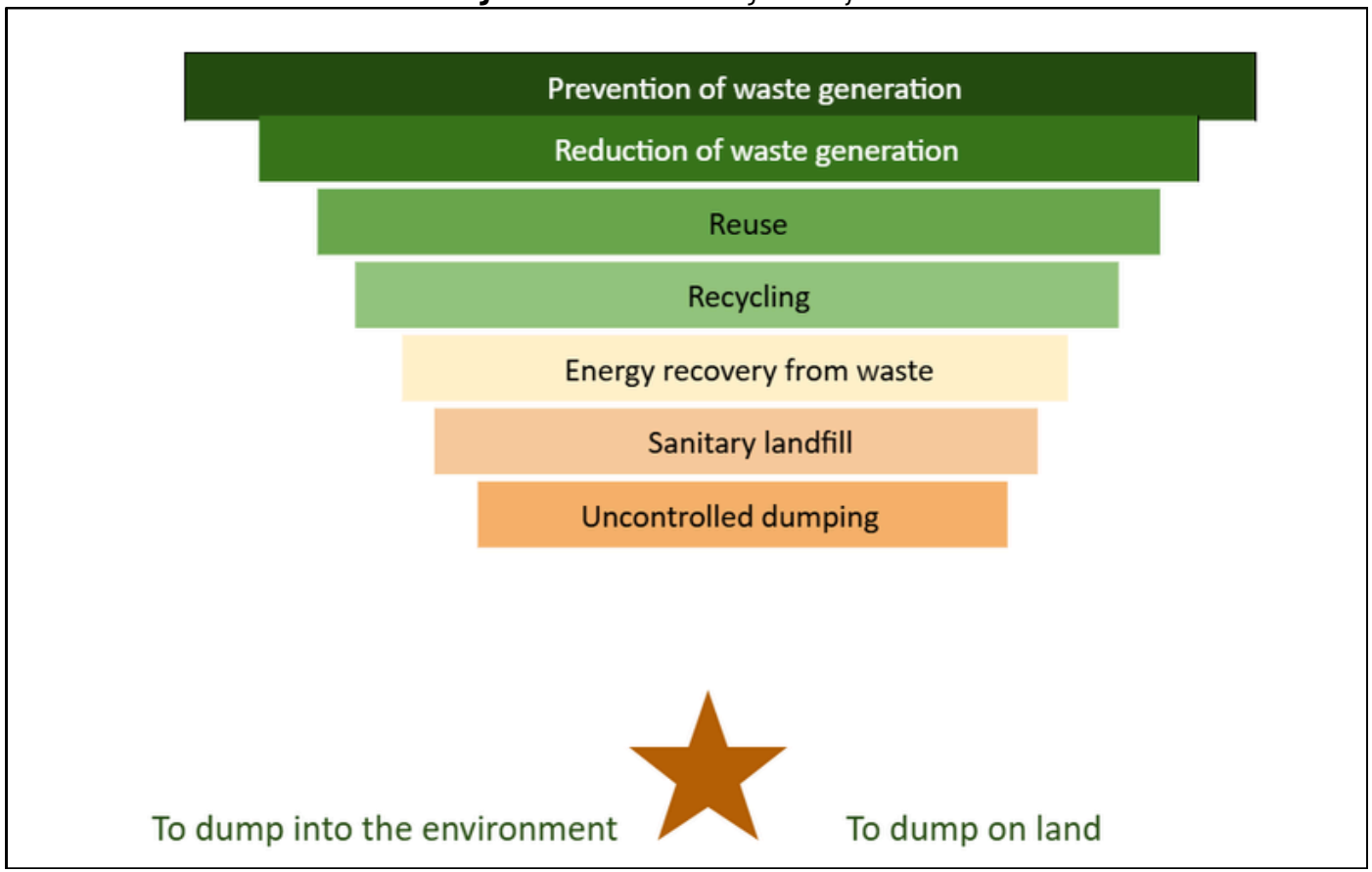
Figure 9: Actors who should take primary responsibility in addressing the problem of pesticide-based plastic pollution



Finally, in the survey interviews, farmers were asked for their solution proposals to prevent plastic pollution caused by pesticides. Based on preliminary research, waste management practices proposed by experts and implemented by various local administrations and public institutions worldwide and in Türkiye were presented as prominent options. Farmers were asked to select the ones they considered most appropriate and effective. Immediately afterward, an open-ended question was posed, inviting farmers to share any other possible solutions they could think of beyond the listed ones.

To prevent pesticide-related plastic pollution, it is essential, first and foremost, to prevent and reduce the production of waste and the products that generate it, as emphasized in the waste management hierarchy. This requires supporting climate change adaptation and mitigation efforts, protecting soil, plant, animal, and environmental health, and promoting agroecological practices as alternatives to pesticide applications in agricultural pest control—thus reducing the demand for pesticides and cutting plastic packaging at the source. While adopting this approach, the present study, which aims to reduce pesticide-related plastic pollution, focuses on how a more inclusive waste management model can be implemented locally under current conditions, in order to improve existing practices from an environmental perspective. Accordingly, the solution options presented to farmers were drawn from practices related to the collection, reuse, recycling, and disposal of pesticide packaging, without making any judgment regarding pesticide use itself.

Figure 10: The Waste Management Pyramid



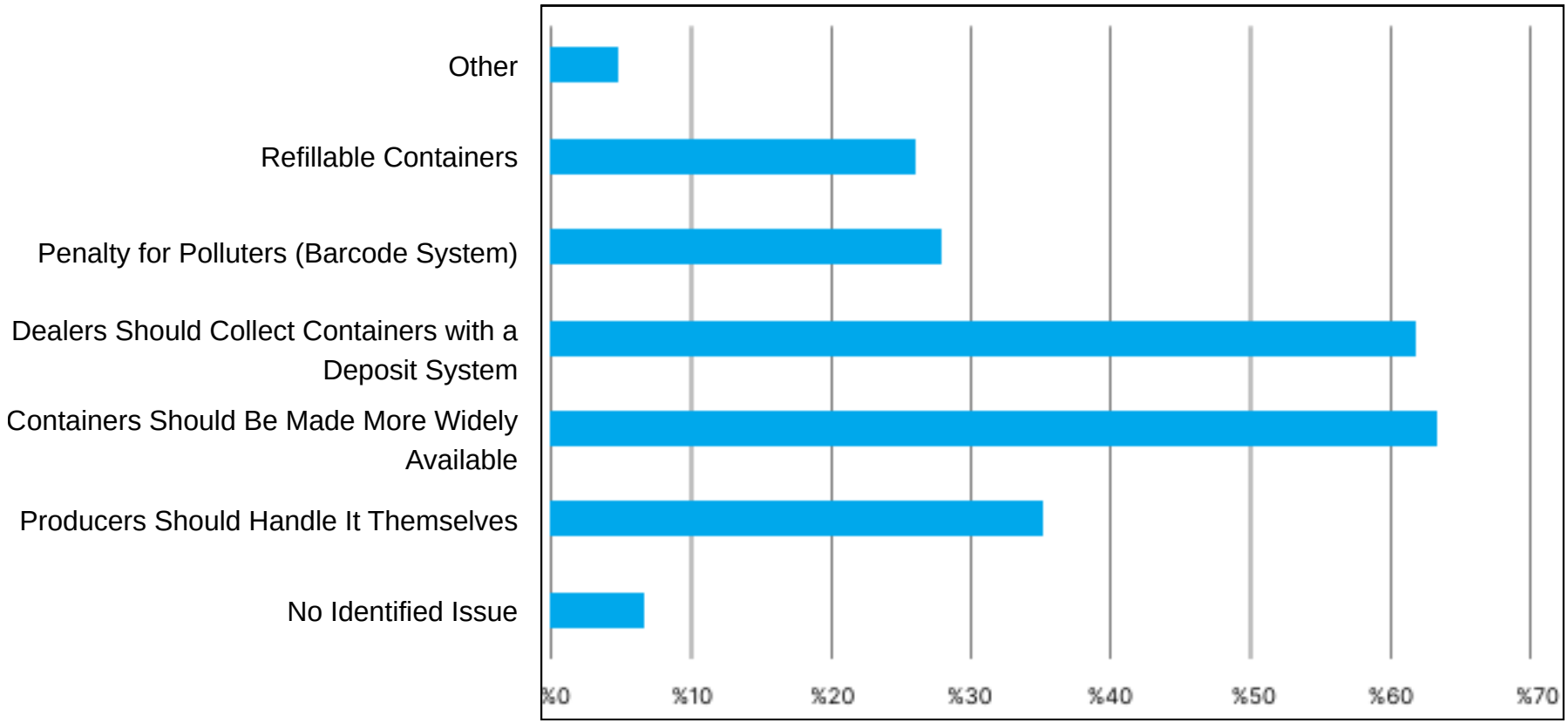
Among the survey options, about 7% of respondents agreed with the statement “I do not think pesticide packaging creates a problem.” The responses of the remaining participants reflected a tendency to acknowledge pesticide packaging waste as a source of pollution and to seek solutions to the issue. About 35% of respondents stated that farmers themselves should solve the problem of pesticide packaging disposal. However, the majority of farmers emphasized the importance of practices that would allow for more systematic collection of waste and make it easier and less costly for farmers to participate in the waste management system. More than 60% of surveyed farmers stated that containers for collecting pesticide packaging should be made more widely available. Additionally, farmers indicated that the waste management system should be developed not through punitive approaches such as barcode-based tracking and fining of polluters, but rather through incentive systems, such as deposit-return schemes already applied for other packaging waste. Farmers also highlighted that retailers of plant protection products would play a key role in the return of waste under such a deposit system. Furthermore, 26.1% of respondents expressed the view that pesticide packaging should be designed to allow refilling.

Among the farmers’ own solution proposals, beyond the listed options, the most common was that farmers should be better informed about this issue and that training programs should be organized. Farmers noted that during the training sessions on plant protection provided by the Provincial/District Directorates of Agriculture and Forestry and Chambers of Agriculture, it would be effective to include guidance on how pesticide packaging waste should be stored, collected, and disposed of, in order to raise awareness on this issue.

Through this survey study, conducted as part of the project aiming to reduce pesticide-related plastic pollution, farmers’ attitudes and awareness regarding pesticides and the disposal of pesticide packaging were analyzed, and their views and suggestions on preventing pesticide-related plastic pollution were collected. It was found that while most farmers do not have a clear opinion on the effectiveness of pesticides, they are aware of the risks they pose to public and environmental health and nonetheless use them in agricultural pest control. Pesticide use varies particularly depending on the size of the farmland and the type of crop produced.

Overall, farmers were found to have relatively high levels of knowledge and awareness regarding pesticides, pesticide application methods, and to some extent disposal practices. This indicates that farmers would be willing to participate in an environmentally sensitive and participatory waste management system and are open to taking more effective measures.

Figure 11: Proposed solutions for preventing pesticide-based plastic pollution



Section 4:

In-Depth Interviews with Agrochemical Retailers and Research Finding

As part of the research, in-depth interviews were conducted with the owners and employees of agrochemical retailers—who are the primary actors from whom producers obtain information on plant protection methods and plant protection products (PPPs), and from whom they directly procure these products. In these interviews, retailers were asked questions regarding their professional perceptions, their general opinions on plant protection methods and pesticides, and their views on plastic and chemical pollution arising from pesticide packaging waste, as well as the roles they assign to themselves in addressing this issue.

In total, interviews were conducted with 15 agrochemical retailers located in various districts of the research area. To ensure a standardized interview flow and to identify the general opinions of regional retailers regarding the research themes, interviews were carried out in a structured format. The questionnaire consisted of three sections.

From market survey interviews

The first part included general questions about the professional backgrounds of the retailers, their daily work routines, and the general state of agricultural production in the region. The second part focused on their knowledge, awareness, and attitudes toward pesticides used in plant protection, as well as their observations regarding pesticide use in the region. The final section included questions about the problems and solution proposals related to pesticide packaging waste. The questionnaire used in these in-depth interviews is provided in Appendix 2.

Retailers are generally located in town centers, often close to local marketplaces, allowing easy access for producers who come to sell or shop at the markets. Agrochemical retail shops typically consist of a modest sales area of about 100–150 square meters and an adjacent storage room. Each shop usually employs three to four people: the owner, who is an agricultural engineer, one or two sales representatives, and typically one employee responsible for cleaning and transporting products. Depending on the owner's economic and social capital, as well as the range of agricultural products sold, the size of the shop and the number of employees may increase.

From market survey interviews

These firms not only retail plant protection products but also sell fertilizers, seeds, feed, agricultural tools, and other agricultural inputs. The owners are usually agricultural engineers who have graduated from university faculties of agriculture, specializing in horticulture, field crops, or plant protection. They perceive themselves as advisors, experts, and solution partners who guide farmers toward "correct" production practices. By providing producers with the necessary inputs and support products to sustain production, they believe they play an important role in enabling agricultural production and thereby ensuring society's food supply.

Retailers describe their work as being both a doctor and a pharmacist. The “doctor” role involves diagnosing plant diseases based on the problems described by farmers and recommending appropriate pesticides. The “pharmacist” role reflects their responsibility for supplying and selling these products, knowing alternatives based on active ingredients that fit farmers’ budgets, and instructing them on the correct dosage, timing, and method of application. In the Kazdağları production basin, retailers reported that, depending on the production season and market days, they interact with an average of 50–60 farmers per day, and that they also visit orchards and fields when necessary.

Retailers defined their daily routines as listening to the problems of farmers visiting the shop, identifying their needs, and recommending and selling appropriate products. Depending on the production season (typically from mid-February to mid-December in this region), they reported interacting with up to 100 farmers per day on market days. Some retailers also considered visits to farmers’ orchards and fields to be a routine part of their work.

A significant portion of the retailers interviewed noted that they were either currently engaged in agricultural production in their villages or nearby areas or had been doing so until recently. These retailers, being directly involved in agricultural production, were also asked about the current state of farming in the region and recent developments. They generally conveyed a narrative of change in agricultural production. The dynamics driving this change included difficulties farmers face in sustaining production, the shortage of agricultural labor, the emergence of new plant diseases linked to climate change, increasing dependency on agricultural inputs, and rising input costs due to economic conditions. Additionally, some retailers pointed out region-specific developments, such as the decline in vegetable cultivation and the increase in fruit production, as well as shifts in cropping patterns toward irrigated crops due to the expansion of irrigation opportunities.

As part of the survey, retailers were asked about their general judgments concerning pesticides. Based on their responses, several common assumptions about the potential harms of pesticides were presented—carefully framed without leading—and their opinions and attitudes were sought. Retailers generally viewed pesticides as a necessity. From their perspective, pesticides are an indispensable and unavoidable aspect of their professional expertise and, when applicable, personal farming experience. Moreover, pesticides are also an economic necessity since their livelihoods depend on their trade

Retailers usually framed this necessity within the context of sustaining agricultural production and preventing crop losses, thereby legitimizing the continued use of pesticides. However, many retailers also acknowledged and considered problematic the unavoidable ecological consequences of pesticides, including their negative impacts on ecosystems, residues in agricultural products, and associated risks to human health.

“I don’t think sustainable agriculture is possible without pesticides. But it is obvious that pesticides are harmful to the environment.” (TEÇ)

“Of course, they are useful when used consciously. Although they certainly have some harm to the environment, production must continue to ensure people’s nutrition. Without pesticides, production would decrease drastically... There is no agriculture without pesticides.” (TMZ)

However, many dealers attribute these potential harms not directly to the products themselves, but rather to incorrect product choices, overdosing, and unconscious use. According to the dealers, the cases of environmental pollution, food safety, and public health problems said to be caused by pesticides are not a de facto result of pesticides, but are essentially linked to farmers’ lack of knowledge and the wrong decisions they make.

“Of course, these need to be used consciously. Especially, the products must be applied to the targeted crops indicated on the labels. Attention must be paid to the pre-harvest intervals after spraying. They must be used at the prescribed dosages and quantities. Of course, the greater need here is for raising awareness among farmers, more than us.” (TMZ)

Interviews with producers and the survey results reveal that farmers obtain information about pesticide products and their applications primarily and mostly exclusively from dealers. Dealers also pointed to this close relationship, noting that producers either come directly to the shop or contact them by phone to seek their advice on pest control and fertilization. However, some dealers emphasized that their guidance is ultimately filtered through the farmers’ own interpretations and is sometimes misunderstood, or not taken into account at all.

“Generally, farmers follow our guidance. About 80 percent of the ones who come to us do so, but the other 20 percent just go their own way. They say ‘I want this one, give me that’…” (TRE)

Dealers were also asked about their observations on farmers’ preferences regarding pest control methods in their region, as well as on various methods and practices introduced by public authorities, such as Good Agricultural Practices (GAP), the Integrated Pest Management (IPM) approach, and the producer logbook. Dealers generally noted that they work with more than one company and brand. They stated that farmers usually favor the most well-known and recognizable brands—corresponding to their market shares—while the dealers themselves identify the necessary active substance based on the symptoms conveyed by farmers and/or their own observations, and then recommend the most affordable product among the relevant brands.

In the interviews, it was noted that, as foreseen under GAP, agricultural production should be carried out under the supervision and guidance of an agricultural consultant. However, dealers stated that this system is no longer promoted by the public sector as strongly as it was at the beginning, and that since farmers do not gain sufficient profit from it, it is neither preferred nor applied anymore. They also described the publicly endorsed IPM approach and the producer logbook practice as merely symbolic.

"Good Agricultural Practices (GAP) exist only in very small areas but are not widespread. Sometimes we even issue invoices for them. What is called GAP is basically the system we already apply. It is simply formalized as GAP. But under normal circumstances, every farmer, whether registered or not, should already be practicing good agriculture. Good agriculture means applying the right product, to the right crop, at the right time, in the right amount. There is no further detail to it." (TMZ)

"GAP was attempted here, but it did not work. Neither our geographical conditions nor our farmers were ready; even we dealers were not." (TGÜ)

"Integrated pest management is not practiced. GAP is only applied so that farmers can earn some extra money. They forced something for about three years, but it was just symbolic." (TKU)

Dealers also mentioned that, for farmers, pesticide applications have now become a routine part of the production cycle—that is, conventional agriculture—and therefore are not taken as seriously as they should be. While farmers do consult dealers on which product to choose, how to apply it, and in what amount, they primarily continue the practices they learned from their fathers, who taught them farming, and they are heavily influenced by their neighbors and other nearby producers. Some dealers expressed the opinion—often negatively—that farmers, who largely maintain small family farming in Türkiye, do not improve themselves, remain bound to traditional production methods, and therefore do not act consciously in pesticide applications either. As one dealer put it, this entire process runs in a "black-market manner."

"Everyone thinks they know what to do because they've been doing it since childhood. Nobody really pays attention." (TÇO)

"They trivialize pesticides instead of treating them as medicine. It should not be treated so casually. Since they spray 50–60 times a year, it has become trivial to them. There are no occupational health precautions; it is a completely haphazard way." (TGÜ)

"...It's hearsay. They either do whatever the pesticide seller says, or whatever their neighbor tells them." (TKU)

Some dealers, on the other hand, think that farmers in this region are much more conscious compared to farmers across Türkiye. They stated that farmers generally have knowledge about pesticides, that they take necessary precautions when applying pesticides, and at the very least, they know what precautions should be taken. Dealers also emphasized that in addition to the training and courses provided by provincial and district directorates of agriculture, their own guidance has played a significant role in spreading this knowledge among farmers and in turning it into practice.

"The most conscious and knowledgeable farmers in Türkiye are in Umurbey and Bayramiç. I could also add Isparta. Farmers there know pesticides well. They are also aware of all the issues we are discussing here.
Some pretend not to know—information is there, but they choose not to apply it. In the sense you mentioned, managing these things sometimes just does not suit their interests." (TBA)

In the interviews, dealers were also asked for their opinions on pollution caused by pesticide packaging waste, which was the focus of this research. They were asked whether such a pollution problem exists in their region and the agricultural production basin where they operate. They were also invited to share their observations about how farmers dispose of pesticide products after use. Additionally, they were asked about their level of knowledge regarding the regulations on the disposal of pesticide packaging, what role they think dealers should have in the waste management system of these products within the framework of legislation or their professional roles, as well as their views on a possible deposit system and their suggestions for alternative solutions.

All of the interviewed dealers stated that, as in every area where agricultural production takes place, pesticide packaging waste pollution is also a problem in their own regions and production basins. They noted that this pollution is most visible at the edges of agricultural lands with intensive production, in irrigation channels, and in streams. In the specific case of Çanakkale, several dealers highlighted Bayramiç Dam as the place where this pollution is most apparent. It was clearly observed that dealers were disturbed by the fact that farmers indiscriminately dump the waste into nature. Some dealers described the problem more holistically, noting that pesticide packaging waste carelessly discarded into the environment creates both chemical and plastic pollution, thereby threatening public health. While some dealers found the disposal project carried out by the Provincial Directorate of Agriculture and Forestry useful, they also noted that despite the placement of collection containers in some villages under this project, the pollution problem persists.

Pesticide packages contaminating the waters of the Bayramiç Dam

"To put it simply—plastic, plastic waste is everywhere. Leaving aside the chemicals inside, the material itself is harmful. Of course. Go to the dam, to its shores—everywhere there are pesticide residues, packaging waste. When you go to the dam here in Bayramiç, it is not a pleasing sight at all." (TYÜ)

"They throw them into the dams. And we irrigate our gardens with that water. Plastics harm our bodies in every way. They also pass to us from the soil. They harm animals, water, everything—and ultimately us." (TÇE)

"The district and provincial agricultural directorates support this; there are many containers, but they don't throw the pesticide waste there. They throw it onto roadsides, into water." (TKU)

In summary, dealers agreed that there is no functioning system for pesticide packaging waste. From the farmers' perspective, these packages are seen as objects that must be gotten rid of, and it was understood that they are constantly seeking ways to dispose of them. For many, the easiest solution has become discarding them indiscriminately into nature. It was apparent that some farmers, acknowledging that these products pose a contamination risk, at least try to remove them from their own production areas—either by dumping them in a remote place in nature or throwing them into flowing water in the hope that the current will carry them away. It was also noted that some farmers believe that water itself neutralizes the harmful effects of pesticides by breaking down their chemical components. Other farmers attempt to get rid of pesticide packaging by burning them, as they do with other agricultural waste, whether organic or inorganic. Dealers also noted that, due to costs and lack of sufficient knowledge, farmers continue to use expired products.

"*I know those areas—those people can barely manage 10 percent of this task. Because their orchards are far away. They don't prepare the mixture here; they say, 'let me prepare it in the orchard,' and go there to do it. It's a matter of personal responsibility."* (TRE)

"As far as I know, they take the collected ones to recycling facilities. The rest create pollution under natural conditions. Normally, the chemical should be emptied, the packaging pierced, rinsed with water, and then disposed of in the recycling bin. But how many actually do this—we can't track that, of course." (TOB)

Section 5:

Conclusion and Evaluation

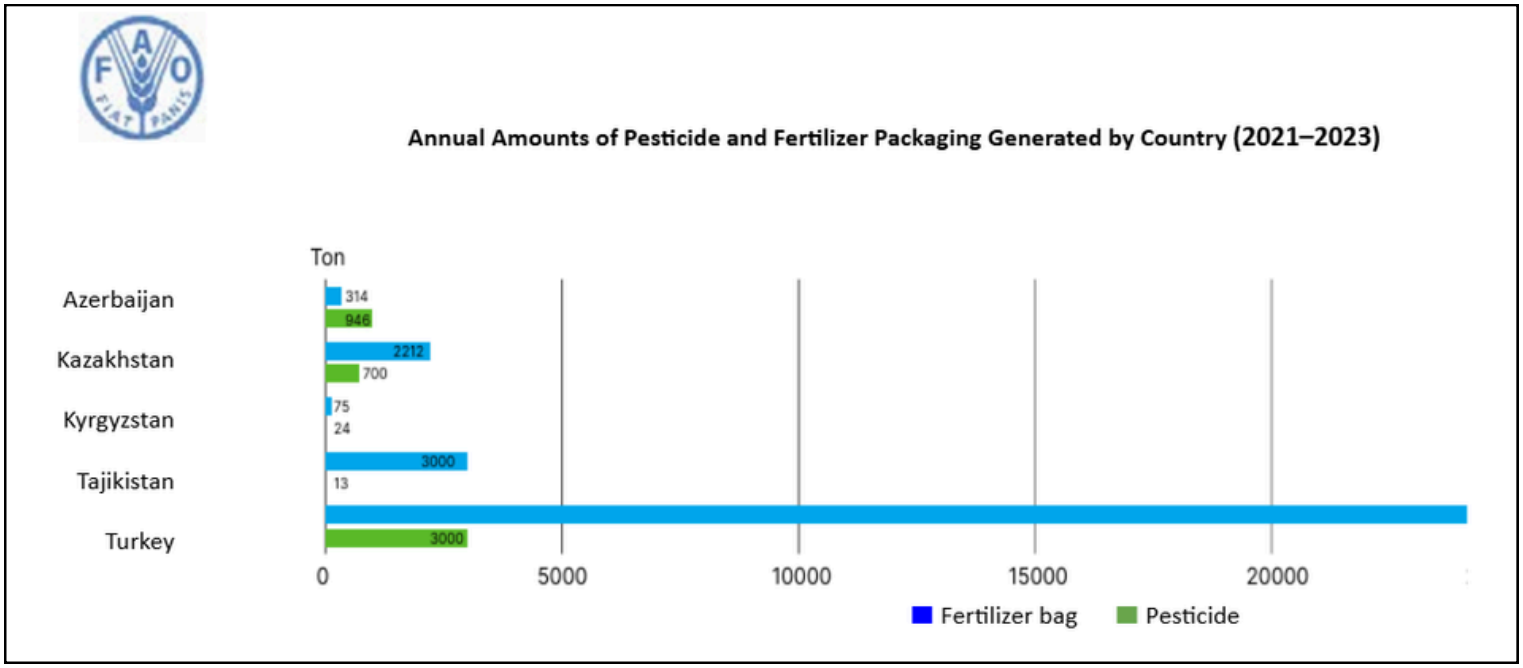
This research report was prepared within the framework of the *"More Responsibility, Less Plastic Project"*, carried out by Yurttaşlık Derneği with the support of the United Nations Environment Fund. The project aimed to develop a participatory and sustainable waste management system for the collection and disposal of pesticide packaging waste generated in agricultural production in Kazdağları and the Edremit Gulf. The report compiles data on pesticide use in agricultural production in the region and the collection and disposal of pesticide packaging waste, presenting the current situation. It also includes the findings of a field study conducted in five districts of Çanakkale and Balıkesir during the autumn and winter months of 2022 with the participation of farmers and dealers who sell pesticide products.

The research focused on the awareness of farmers and dealers in the region regarding plastic pollution caused by pesticide packaging waste, as well as their suggestions for solutions. In addition, the survey examined farmers' practices in plant protection, their pesticide use, and their general knowledge and awareness about pesticides. In the in-depth interviews with dealers, beyond these aspects, the focus was placed on their role within the pesticide waste management system. This section summarizes the research findings and analyses, and presents the participants' proposals for the development of an ecological, sustainable, and inclusive waste management system to reduce pesticide-related plastic and chemical pollution.

Today, what is considered conventional agriculture is largely based on intensive, monoculture production and on agricultural knowledge and techniques suited to this model of farming and crop protection. Looking at the historical development of agriculture, pesticides and plastics, which have not been part of agricultural and food systems for very long, have now become two of the most important components of today's industrial agriculture system, which is centered on productivity and efficiency. According to FAO data, in 2019, 12.5 million tons of plastic were used worldwide for crop and livestock production, and 37.3 million tons for food packaging. Beyond these figures, if we consider the lack of data on plastics used in food supply chains—storage, processing, and distribution—it becomes clear that a significant portion of the 460 million tons of plastics produced globally in 2019 were used in agriculture and food systems (FAO, 2021; OECD, 2023). Similarly, FAO data reveal the increasing and widespread use of pesticides year after year. In 2021, a total of 3.5 million metric tons of pesticides (in terms of active ingredients) were used globally in agriculture. Pesticide use has doubled in the roughly 25 years since 1990 (FAO, 2023). These figures demonstrate that the increasing use of plastics and pesticides has made their presence indispensable for the industrial agriculture and food system. On the other hand, plastics and pesticides are also becoming a growing subject of debate due to the consequences they create, especially in the fields of agriculture and food, as their use intensifies and spreads.

Some studies, taking into account the impact of plastics used in agriculture (such as mulching films, greenhouse covers, drip irrigation pipes, etc.) or pesticides used in plant protection on production efficiency, argue that in the absence of these inputs, much larger areas would be needed to achieve today's production volumes, given the shrinking amount of agricultural land available. On the other hand, an increasing number of studies question the impact of rising and often unconscious use of plastics and pesticides on productivity, and moreover, discuss their adverse effects on the environment and on the health of humans and other living beings due to plastic and chemical pollution. In short, plastics and pesticides stand at the center of a multidimensional debate in agriculture and food systems, where concerns about resilience and sustainability are intensifying in the face of multiple crises. These two major areas of concern intersect specifically in pesticide packaging, creating a new focal point of debate.

Figure 12: Agricultural Plastic Use in Europe and Central Asia (FAO)



In recent years, pollution caused by pesticide packaging has begun to be discussed as a global issue. The main reason is that pollutants such as pesticide residues and empty pesticide containers do not decompose naturally, and thus remain as significant pollutants. Pesticide containers carelessly discarded into the environment cause soil and water pollution. Furthermore, various harmful chemicals can return to humans through the food chain and inhalation, posing risks to human health. The careless reuse of empty pesticide containers or their use as food and water containers can also cause various cases of pesticide poisoning.

If not properly disposed of, the plastic and chemical pollution caused by pesticide packaging does not only contaminate one area but can also spread to distant regions. In response to this major problem, many countries have begun to implement different waste management practices.

The life cycle of pesticide products continues after their use in agricultural production and plant protection. The packaging that contains pesticides, depending on the degree of contamination by residual pesticides, becomes hazardous waste after use and therefore falls under waste management systems. Used pesticide packaging (plastic and other materials) is classified as hazardous waste within the scope of waste management regulations in all countries, as they are considered containers that contain residues of hazardous substances or are contaminated with such substances.

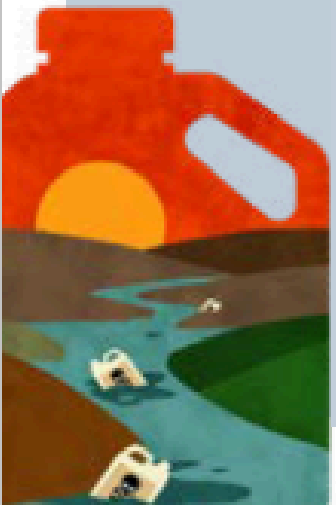
In Türkiye, waste management policies, legal regulations, and national waste action plans have been formulated in line with the European Union (EU) harmonization process and are compatible with international legislation in this field. Pesticide packaging waste is also addressed within this advanced waste management legislation, and depending on the hazard level of the substance inside, it is considered under the definition of hazardous waste and managed accordingly. While there are specific waste management regulations in Türkiye for certain products, depending on their economic value or potential to cause problems, pesticide packaging waste is not among these categories. Therefore, it can be argued that there are shortcomings in both legislation and practice regarding the management of pesticide packaging waste. Despite the existence of a developed waste management framework, in the specific case of pesticide packaging, there is no effective and sustainable nationwide waste management practice for the collection, transportation, recovery, and disposal of these wastes, nor for the administration, monitoring, and oversight of all these activities. As in many countries, in Türkiye too, pesticide packaging is not closely monitored, and there is no effective and sustainable method for managing their quantities, collection, and disposal. As a result, pollution caused by pesticide packaging waste is particularly evident in agricultural basins where pesticide use is intense.

EXTENDED PRODUCER RESPONSIBILITY IN PESTICIDE PACKAGING AND PLASTIC WASTE MANAGEMENT

IN THE KAZDAĞLARI AND EDREMIT BAY REGION

CITIZENS ASSEMBLY

CITIZENS' ASSEMBLY



THE FIELD RESEARCH REPORT

OCTOBER 2023

The issue of pesticide packaging waste and associated pollution is addressed by public administration within the framework of the "polluter pays" principle, which underlies the general waste management system. However, neither disposal methods nor strict monitoring and supervision regarding pollution and polluters are effectively implemented. This situation means that waste is not managed in accordance with the priorities outlined in the internationally recognized waste management hierarchy and the zero-waste objective—that is, reducing and preventing waste at the source, reusing it, or recycling/recovering waste that cannot be reused. In Türkiye, waste management for pesticide packaging waste focuses on the lowest level of the hierarchy, "disposal," and is managed with an approach that does not aim for progress toward higher levels.

By law, farmers, as the end-users of pesticides and "individuals and enterprises whose activities generate waste," are considered waste producers. According to waste management legislation, waste producers are obligated to store hazardous waste, keep records, develop a waste management plan, label waste, transport it, and send it to licensed waste treatment facilities. Unfortunately, considering pesticide packaging waste as an integral part of the rural landscape, it is questionable to what extent farmers can fulfill these obligations.

Although the principles of Extended Producer Responsibility (EPR), an effective approach and model for achieving reuse, recycling, and recovery goals in waste management, have been recognized in waste management legislation, there is no specific EPR model established or applied for pesticide packaging. For example, there is no nationwide deposit system specifically for pesticide packaging. However, in recent years, some local-scale waste management initiatives have begun experimenting with incentive models similar to deposit systems to increase producers' participation in disposal systems.

Another actor in the waste cycle or the waste value chain of pesticides is the producer/importer firms that market the pesticides. Under waste management legislation, pesticide producers and/or suppliers are required to pay a “recovery participation fee” for the packaging of the pesticide products they put on the market, as with other packaged products. This fee is collected to provide a significant financial resource for financing waste management. Examination of legislation and practice indicates that firms’ responsibilities and actual participation within the waste management system are largely limited to this financial contribution. Even in local initiatives resembling a deposit-return system, it is difficult to claim that producer and supplier firms, outside of their corporate social responsibility projects, adopt a broader responsibility approach—for example, collecting and recycling empty packaging or marketing products in refillable containers. Producers’ reluctance to participate in these processes is justified by the contribution fee they pay to the ministry when bringing the packaged product to market. In other words, the fee collected from consumers, added on top of the product price and paid as a contribution, is considered sufficient responsibility for the producers. Currently, the recovery participation fee can be regarded as the maximum extent of responsibility for producer and supplier firms. From their perspective, responsibility lies with farmers as waste producers, and with the public sector, which must establish a waste management system to collect and process this fee.

It is also observed that the Association of Plant Protection Pesticide Producers (ZİMİD), of which many key pesticide producers and suppliers are members, primarily focuses on raising awareness and promoting knowledge on pesticide use and applications. Issues such as reducing pesticide packaging waste or its proper disposal fall outside the main scope of the association’s work. During the research period, no evidence was found in the literature that pesticide producers and sellers, members of this association, had assumed any notable responsibility in this context.

Local administrations, i.e., municipalities, are another key actor in the waste management system. According to waste management legislation, municipalities are responsible for planning waste management, collecting and transporting waste, managing proper storage and disposal, establishing the necessary facilities, and ensuring the functioning of the entire system.

However, when it comes to hazardous waste and pesticide packaging waste, municipal responsibilities become ambiguous. In such cases, local governments, constrained by authority, budget, and capacity, generally choose not to take responsibility for pesticide packaging waste. In the local practices mentioned above, some municipalities have assumed responsibility for the collection, transportation, and storage of pesticide packaging waste within their means and budgets and have conducted awareness-raising activities. For example, in the project conducted in Bayramiç, Çanakkale, packaging waste accumulated in village containers is periodically transported by Bayramiç Municipality vehicles to the central collection facility in the district center.

Examining waste management systems implemented in other countries specifically for pesticide packaging waste, participatory examples emerge where producer organizations, cooperatives, and other actors operate collectively, and waste associations are designed as more active and effective participants in the management system.

In Türkiye, some district chambers of agriculture and agricultural cooperatives, although not their main area of activity, attempt to provide members with inputs under better conditions and, in some cases, also act as dealers of certain firms, facilitating the procurement and sale of pesticide products. However, in the research area, no producer organization was observed to have undertaken initiatives regarding the collection and disposal of the packaging waste of the products they supply. Given the absence of punitive responsibility or incentive models, it is unrealistic to expect these producer organizations to act voluntarily considering their current capacities. Nonetheless, these organizations, of which producers are members or partners, from whom they receive information, through which they procure inputs and sell products, can play a significant role in reducing waste at the source and in establishing a more inclusive waste management system that allows recovery and recycling.

Although the number of locally implemented waste management system examples in some provinces and districts in Türkiye with intensive agricultural production has increased over the last decade, as also highlighted in this report, the vast majority of empty pesticide containers are disposed of randomly by producers.

From the Agricultural Waste Collection Project of **İzmir Metropolitan Municipality**

From the 'Environmentally Friendly Farmer Card' practice of **Antalya Metropolitan Municipality** in Kumluca

Among the containers that can be collected in some way through local waste management systems and traditional collection practices and incorporated into the waste management system, most are disposed of without being recycled. Through comprehensive planning, multi-stakeholder organization, and considerable budget allocation, hazardous waste that can be collected at the source is first transported to temporary storage centers and then to licensed waste facilities, where it is incinerated collectively. Waste whose hazardous nature is uncertain is incinerated in licensed and supervised facilities authorized for waste burning. In a way, this can be seen as a larger-scale, regional, public-level version of farmers' efforts to remove pesticide packaging waste—which they are compelled to dispose of and perceive as risky—from their immediate environment through various methods. Pollution cannot be fully prevented; in a sense, it is transferred, its nature altered, and, at best, filtered at the facility where it is incinerated, diluted, and released into the air.

Thanks to its geography, climate, and soil characteristics, the Kazdağları and Edremit Gulf basin is a region with significant agricultural production value, capable of growing a wide variety of crops. Within the region's broad range of crops, the share of fruits and vegetables has increased over time and is higher compared to other agricultural basins. It is known that more intensive pesticide use is applied in fruit and vegetable production to reduce yield losses caused by plant diseases and pests.

However, due to the intersection of interrelated processes such as climate change, biodiversity loss, and declining soil quality, new plant diseases have emerged in the basin, with their prevalence and frequency increasing. Experts have pointed out that, due to intensive, mistimed, or improper pesticide applications, certain pest species have developed pesticide resistance to specific active ingredients, leading to an increase over the years in the number of pesticide applications in a given season. In this region, where all these developments have left their mark, both producers and pesticide retailers report that pesticide use in agricultural pest control has inevitably increased in recent years. This trend is also reflected in provincial-level pesticide use data shared by the Ministry of Agriculture and Forestry, showing that Balıkesir and Çanakkale are among the provinces with the highest per-unit-area pesticide use in Türkiye.

As the field research indicates, regardless of whether they personally use pesticides, their level of knowledge about pesticides, or their perception of pesticide effectiveness, the vast majority of producers view pesticides as a necessity for agricultural production and pest control. Most farmers seek to maximize their yield to secure their livelihood and report that pesticides are essential for this purpose. For pesticide retailers, this narrative of necessity is framed through their professional training, scientific rationale, and ultimately as a matter of income and livelihood. In summary, two out of every three farmers producing in the region report using pesticides in pest control.

Although farmers do not reach complete consensus on the effectiveness of pesticides in pest control, a majority still apply them. A significant number of farmers use pesticides despite recognizing their ineffectiveness or being aware of potential hazards. Farmers producing for the market, beyond their own consumption, tend to have higher pesticide use rates. Some pesticide-using producers avoid applying pesticides in areas where they grow products for their own consumption, indicating awareness of pesticides, their application, and their effects. Another finding from the research is that the number of pesticide applications within a production season increases depending on the production area and crop type. Particularly for fruits like apples, peaches, and cherries, which are intensively cultivated in the region, some producers report applying pesticides more than ten times a year.

A substantial portion of producers who do not use pesticides in pest control base this decision on their observations and views regarding the potential impacts of pesticides on the environment and human health. Some also consider pesticides a significant production cost and choose—or are compelled—to avoid or stop using them for economic reasons. Although very few farmers have attended courses or training on pesticide application, it can be said that awareness and consciousness about both pesticides and the precautions to be taken during their application are relatively high. Some experts and pesticide retailers also confirm producers' awareness of pesticides and attribute it to the relatively higher education level of farmers in the region.

Given the extensive reliance on pesticides for pest control in the Kazdağları and Edremit Gulf region, pesticide packaging waste has become a significant environmental pollution, public health, and food safety risk. Producers and retailers report that most used pesticide containers are randomly discarded into the environment, accumulated on fields and burned, or buried in the soil. Most producers are aware of the adverse environmental and human health impacts resulting from such disposal practices. They also perceive the disposal of pesticide containers as a problem that needs to be addressed. In summary, pesticide packaging waste is seen as an issue by producers in the region. While this issue may be secondary among the agricultural problems for which producers seek solutions, they do notice the pollution, it concerns them, and they believe that addressing the problem requires farmers themselves—that is, their own—taking responsibility.

Over the past ten years, plastic pollution caused by pesticide packaging in the basin has periodically entered the public agenda, prompting local-level responses from certain public institutions in Çanakkale aimed at addressing the issue. As a result of initiatives by the Çanakkale Governorship in 2017, a project for the collection and disposal of pesticide packaging waste was launched in the Bayramiç district under the leadership of the Çanakkale Provincial Directorate of Agriculture and Forestry. In the following years, the project was extended to the districts of Merkez, Biga, Ezine, and Eceabat through collaborations with various institutions, and it continues to operate in these five districts.

From the presentation of **Çanakkale Provincial Directorate of Agriculture and Forestry**, dated April 11, 2023

Within the scope of the project, villages with intensive agricultural production—and consequently high pesticide use—were identified, and pesticide preparation units as well as containers for collecting empty pesticide packaging were placed at designated points in these villages. The pesticide packaging waste accumulated in these containers is first transported to a local waste collection center established in Bayramiç. Under a protocol with a waste disposal facility located in Balıkesir, the collected pesticide packaging waste is then transported by the company and incinerated for disposal. Between 2018 and 2022, approximately 21,500 kg of empty agricultural packaging waste was collected and disposed of through the project.

Although the disposal rate is not at the desired level when compared with annual pesticide use in the province or in the districts where the project is implemented, a significant amount of pesticide packaging waste has nonetheless been removed from the environment and properly disposed of. Moreover, awareness-raising activities conducted as part of the project have increased producers' understanding of the issue, resulting in positive behavioral changes among many farmers. Observations in the districts and villages where the project is implemented indicate that containers are being used by producers, with a substantial amount of pesticide packaging waste collected at these points. Surveys also indicate that producers in villages with containers are less likely to leave empty pesticide packaging in the environment, burn it, or mix it with other waste.

In this sense, the ongoing project and the pesticide-specific collection containers can be considered effective in terms of collecting pesticide packaging waste and ensuring its controlled disposal.

Given its implementation and outcomes, this project represents one of the good practice examples in Türkiye in this field and serves as a model for other regions.[17] In villages outside the project implementation area, discussions have indicated that one of the first suggested measures to prevent pesticide packaging pollution is the placement of collection containers in these villages as well. The project has had an impact beyond the immediate implementation area.

However, interviews also highlighted certain shortcomings and complaints regarding the project's implementation, and the following suggestions were proposed to improve the system:

- Producers consider the number of containers insufficient. Villages without containers request their installation, while villages already equipped with containers and intensive production call for an increase in container numbers.
- Containers are being used for other types of waste besides pesticide packaging.
- Containers quickly fill during certain periods of the production season. When they are not emptied regularly, waste accumulates around the containers, forcing producers to dispose of it using their own methods.
- Many producers note that container locations could be better selected. As the distance from fields to containers increases, producers are less likely to use the containers.
- Damaged containers are not replaced in a timely manner.
- At many container locations, pesticide preparation or washing units are not available.
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In summary, the containers placed in villages and the informational meetings conducted within the scope of the project have generated interest, enthusiasm, and behavioral changes among producers regarding the collection and controlled disposal of pesticide packaging waste. However, uncertainties in responsibility sharing, budget constraints, and communication gaps have led to implementation challenges, which in turn create distrust among producers and reduce participation in the system.

17. During the research, no initiatives addressing the disposal of pesticide packaging waste were encountered in Balıkesir. However, during the writing of this report, it was noted that the "Zero Waste in the Field" project, which targets the collection of all agricultural waste rather than focusing solely on pesticide packaging, has been implemented under the leadership of Balıkesir Metropolitan Municipality

Recommendations

For a farmer whose life is spent in and sustained by agriculture, farming is not only a way of life but also a struggle for survival. A significant part of this struggle takes place in and with nature. For the agricultural producer, plant protection against pests and diseases is intrinsic to farming. Knowledge and methods of plant protection evolve and develop alongside agricultural practices. Farmers' agricultural knowledge is shaped by their own experiences, observations, and learning. Their current and effective knowledge is derived less from instructions and messages of official institutions and more from "traditional" knowledge passed down from previous generations, their direct experiences with nature, and observations of the practices of nearby producers. The social and economic dimensions of production also play a role in shaping traditional knowledge. Farmers blend their traditional knowledge with (increasingly blurred) scientific knowledge and market information to shape their agricultural practices and determine production and pest control methods.

The use of pesticides in plant protection has long been part of the traditional knowledge base of producers. Farmers' knowledge of plant protection is formed at the intersection of inherited knowledge, accessible information (such as product labels, publications and training by agricultural chambers and other producer organizations, and the provincial/district directorates of agriculture and forestry), and awareness of the benefits and harms of pesticides. This knowledge, awareness, and behavior patterns have developed through this combination.

Contents

- A national-level waste management plan, legal framework, and action plan are needed in Türkiye specifically for pesticide packaging waste, addressing waste reduction, proper collection, recycling, recovery, or safe disposal.

- Existing (hazardous) waste legislation and practices governing the collection, transport, and disposal of pesticide packaging waste should be re-evaluated with a focus on waste reduction and recovery. A fairer distribution of responsibility among relevant actors should be ensured, based on the principle of Extended Producer Responsibility (EPR).

- Successful local waste management systems should be studied, improved, and expanded. Examples that have yielded good results in waste reduction and recovery should be analyzed, modeled, promoted, and scaled through collaborations in other regions.

- Developed waste management systems should aim not only at reducing and recovering waste but also at gradually reducing pesticide use over the long term.

- Waste management planning at the agricultural basin level should adopt a participatory approach. A comprehensive and sustainable waste management plan for pesticide packaging should be developed with the participation of all relevant actors, including local units of the Ministry of Agriculture and Forestry, the Ministry of Environment, Urbanization and Climate Change, municipalities, waste associations, universities, chambers of industry and commerce, waste companies, agricultural chambers, producer unions and cooperatives, pesticide product sellers, agricultural engineers, and environmental NGOs.

- In local-level waste management systems, incineration of waste should be avoided. Instead of incineration—which is a significant source of air pollution—the approach used worldwide should be adopted: pesticide packaging should be separated from hazardous waste and transformed into materials that do not endanger human health or food safety, with licensed recycling firms encouraged to carry out this process.

- Farmers are willing to participate in a waste management system that is regular, operational, and responsive to their conditions and demands. Mechanisms for regular information sharing, consultation, and collaboration should be established to increase their involvement in planning and implementation.

- Collection, disposal, and recovery of waste should be structured not only as a punitive "polluter pays" system but also as a reward-based system that incentivizes waste reduction and proper disposal. Deposit systems for pesticide packaging collection should be implemented in pilot regions.

- Ultimately, reducing pollution from pesticide packaging fundamentally depends on reducing pesticide use. The most effective solution is the adoption of an agricultural production system and plant protection approach that does not rely on pesticides. Agroecological methods that reduce the effects of plant diseases and pests and enhance adaptation to climate change should be promoted and incentivized, so that pesticides no longer become the first option in plant protection.

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