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STUDY REGARDING THE USE OF PHYTOSANITARY PROTECTION PRODUCTS IN ROMANIA AND EUROPEAN COUNTRIES IN THE PERIOD 2011-2019

Cristian Bradut IORDAN, Liviu MARCUTA, Alina MARCUTA, Stelica CRISTEA

University of Agronomic Sciences and Veterinary Medicine Bucharest, 59 Marasti Boulevard, District 1, 011464, Bucharest, Romania, Phone: +40213182564, Fax:+40213182888, Mobile:+40723 2923 41, Emails: iordanbradutc@yahoo.com, liviumarcuta@yahoo.com, alinamarcuta@yahoo.com, stelicacristea@yahoo.com

Corresponding author: iordanbradutc@yahoo.com

Abstract

The use of pesticides is a growing problem for the environment given the negative impact it has on the quality of soil, groundwater and surface water, biodiversity and ecosystems, but also on human health. To these are added the emergence of new diseases and pests that must be combated, precisely as a result of changes in the environment and climate change. However, their use is necessary, given the growing need for food, as a result of the exponential growth of the world's population and the reduction of areas for agriculture. The use of the latest generation pesticides, their correct application leads not only to the increase of their productions and to their profitability, but also to the protection of the environment and the preservation of biodiversity. In this paper, we aim to analyze the evolution of pesticide consumption in the E.U. and at the level of Romania in the period 2011-2019. The research methodology involved the bibliographic study, the consultation of domestic and international databases, the analysis of statistical data, their interpretation and the formulation of conclusions on the current situation compared to the base year, so that we can estimate what future developments will be.

Key words**:** *pesticides, production, consumption, environmental protection*

INTRODUCTION

Agriculture is one of the most important branches of an economy, but it faces the paradigm of increasing production, ensuring increasing food resources, but also the impact that its practice has on the environment [7, 12].

The use of phytosanitary protection substances is one of the major problems facing agriculture, and the development of new products is one of the major concerns of agrochemical companies that develop both new products and new technologies, without being able to fully anticipate the risks that may arise [3, 4].

The category of pesticides includes plant protection products (insecticides, fungicides, herbicides) that have the role of combating diseases and pests, also contributing to influencing vital processes for plants, preserving plant products, destroying some plants or parts of them with negative effect on crops. Besides the disadvantages brought by the use of phytosanitary protection products, with effect on the environment and on human health, they also have numerous advantages [11]. The globalization of trade has been made possible precisely by the fact that the use of chemicals has contributed both to improving the appearance of agricultural products and to the possibility of their long-term preservation [1]. Although there are risks, the consumption of phytosanitary products, worldwide, is constantly growing. Careful monitoring of these consumptions is one of the important objectives of existing policies in the European Union and in the world, given the objectives of limiting climate change, but also of promoting sustainable development models that seek not only to protect the environment., but also ensuring human well-being [5, 6].

At the same time, climate change is contributing to changes in the geographical structure of crops, which are accompanied by migration of diseases and pests that require

more phytosanitary protection and, on the other hand, accelerate their behaviour [13].
Careful monitoring of transparency, transparency in the quantities used will help reduce the risks that pesticide use poses to the environment and to human health.

MATERIALS AND METHODS

The research methodology involved bibliographic study, data collection, processing, analysis and interpretation. In this sense, a significant number of specialized articles were studied, as well as EUROSTAT statistics. Fixed-base and chain-based indices were calculated that highlighted the increase or decrease of the researched phenomenon for the period 2011-2019. We mention the year 2019 was chosen as at the moment while we were running the research work, there were no data for all the EU countries for the year 2020. The basis of the comparison was the year 2011, a function for which the absolute changes for the analyzed interval were determined, according to the following formulas:

$\Delta_{t/1} = y_t - y_1$,

$\Delta_{t/t-1} = y_t - y_{t-1}$, [14]

where:
y_1 - the value of the reference indicator
y_t - the value of the indicator in period t
y_{t-1} - the value of the indicator in the period t-1

RESULTS AND DISCUSSIONS

At the level of existing statistics at the EU level. There is very little data on the consumption of plant protection products, although their use and evidence is regulated by the Common Agricultural Policy, but also by the EU Regulations. 178/2002, 183/2005, 1107/2009 [8, 9, 10].
Therefore, the present study was based on the use of information regarding the quantities of products sold and not used.
Analyzing the situation of pesticide sales in European countries, and starting from Eurostat data, eliminating countries such as Bulgaria, Croatia, Estonia, Luxembourg, Malta and Iceland either due to lack of data or due to their confidentiality, we find that for the period 2011-2019 , the first 5 places were occupied in 2011 by Italy (43,574 tons), Spain (31,343 tons), France (24,496 tons), Germany (10,473 tons) and Portugal (5,767 tons). At the level of this year, Romania ranks 7th, with a sales value of 3,842 tons. The last 5 places were occupied by Cyprus, Sweden, Finland, Lithuania and Norway (Table 1).

Table 1. Evolution of pesticide sales during 2011-2019 (tons)

Country	Fungicides and bactericides	
	2011	2019
Italy	43,574	24,286
Spain	31,343	34,073
France	24,496	24,484
Germany	10,473	10,217
Portugal	9,975	5,767
Poland	6,081	6,867
Netherlands	4,250	3,897
Romania	3,482	4,021
Hungary	2,997	2,796
Belgium	2,452	2,449
Greece	2,256	1,756
Czechia	1,627	1,651
Austria	1,544	2,068
Switzerland	933	954
Slovenia	797	752
Denmark	633	436
Ireland	620	922
Slovakia	541	653
Lithuania	362	575
Cyprus	250	867
Sweden	218	164
Finland	165	2,832
Latvia	148	295
Norway	107	77

Source: own processing according to Eurostat [2].

It can be seen that the consumption of fungicides and bactericides is directly related to the agricultural area owned by these countries. In 2019, Romania maintained the same position (4,021 tons), while Poland climbed to 5th place, and Portugal ranked 6th

(5,767 tons). Finland also ranks 9th and Cyprus 17th, while Lithuania, Norway and Sweden remain the lowest consumers of fungicides and bactericides (Table 1).

Although Italy and Spain ranked 1st and 2nd in terms of sales, we find that sales decreased by 45% in Italy in 2019 compared to 2011, while in Spain they increased by 9%.

Table 2. Evolution of sales of herbicides, haulm destructors and moss killers in the period 2011-2019 (tons)

Country	Herbicides, haulm destructors and moss killers	
	2011	2019
France	29,252	22,484
Germany	17,955	13,941
Spain	13,835	17,023
Poland	12,408	11,705
Italy	8,327	8,524
Romania	6,771	4,013
Denmark	3,692	2,026
Hungary	3,668	3,906
Czechia	3,473	2,399
Netherlands	3,025	2,739
Ireland	2,812	1,845
Belgium	2,611	2,328
Sweden	2,136	1,544
Portugal	1,996	2,222
Lithuania	1,773	1,199
Austria	1,505	1,151
Greece	1,455	1,830
Finland	1,452	1,107
Slovakia	1,080	1,160
Switzerland	919	509
Latvia	722	972
Norway	679	479
Estonia	357	531
Slovenia	264	172
Cyprus	170	168
Luxembourg	102	54
Malta	6	2

Source: own processing according to Eurostat [2].

The largest increases were in Cyprus (+ 246%), Latvia (+ 99%), Lithuania (+ 59%), Ireland (+ 48%) and Austria (+ 34%). The largest reductions in sales of fungicides and bactericides were in Italy (-45%), Portugal (-42%), Denmark (-31%), Sweden (-25%) and Greece (-22%).

Regarding the herbicides, haulm destructors and moss killers, the first 5 places in terms of sales, they were occupied in 2011 by France (29,252 tons), Germany (17,955 tons), Spain (13,835 tons), Poland (12,480 tons) and Italy (8,327 tons). Romania ranks 6th with a sales volume of 6,771 tons (Table 2).

The last places were held by Cyprus (170 tons), Luxembourg (102 tons) and Malta (6 tons). However, we note that although the ranking for the top 5 countries is maintained at the level of 2019, there are significant changes in terms of quantities sold.

Thus, France, although registering a 23% decrease in sales, remains on the same place 1, Germany with a 22% decrease occupies the 3rd place, Poland with a decrease of 6% remains on the 4th place (Table 2).

Italy with a sales increase of 2% % remains on the 5th place, and Spain with an increase of 23% occupies the 2nd place.

Although Romania registered a 41% decrease in sales, it occupies the same place 6. Estonian (49%), Latvia (35%) and Greece (26%) registered significant increases in sales of herbicides, haulm destructors and moss killers.

At the same time, there were significant decreases in sales in Malta (64%), Luxembourg (47%) and Denmark (45%)(Table 2).

Sales of insecticides and acaricides are in line with the same trend of phytosanitary protection substances, with the first places being countries with high agricultural areas or intensive agriculture.

The first 5 places in 2011 were occupied by Germany (11,832 tons), Spain (8,062 tons), Italy (2,494 tons), France (2,190 tons) and the Netherlands (1,898 tons).

The last 5 places are occupied by Sweden, Lithuania, Estonia, Norway and Malta.

What stands out compared to 2019 is a very large increase in the consumption of insecticides and acaricides in countries such as Greece (+ 783%), Austria (+ 550%), Lithuania (+ 187%), Poland (+ 175%) or

Slovakia (+ 133%). In other countries such as Italy and Malta, sales fell by 37%.
Romania maintained its sales level at about 800 tons (Table 3).

Table 3. Evolution of insecticide and acaricide sales (tons)

Country	Insecticides and acaricides	
	2011	2019
Germany	11,832	18,665
Spain	8,062	7,636
Italy	2,494	1,683
France	2,190	4,367
Netherlands	1,898	1,959
Poland	991	2,724
Portugal	878	812
Romania	808	809
Belgium	695	359
Hungary	522	690
Czechia	291	307
Switzerland	261	294
Austria	248	1,613
Cyprus	179	135
Greece	109	965
Slovakia	64	149
Ireland	48	23
Denmark	45	57
Slovenia	38	36
Latvia	34	39
Finland	31	23
Sweden	29	45
Lithuania	26	76
Estonia	19	33
Norway	5	8
Malta	4	3

Source: own processing according to Eurostat [2].

Plant growth regulators registered increased sales. They are very important chemicals, biosynthesized in plants with a deep influence in the physiological processes destined to help plants to grow and develop.
Seed germination, seedling growth and plant development are more and more under the impact of climate change with a negative economic impact on yields and production, and also from a biological point of view.
Plant growth regulators are destined to help plants to adapt much better to abiotic stresses and environment changes.
That is why the sales of plant growth regulators increased from 2011 to 2019 in countries such as Slovenia (+1,180%), Greece (+ 529%), Slovakia (+ 189%) or Estonia (+ 141%).
Romania (-80%), the Czech Republic (-32%) or Germany and Spain (approximately 35%) decreased sales.
The other countries had moderate increases or decreases (Table 4).

Table 4. Evolution of plant growth regulators sales (tons)

Country	Plant growth regulators	
	2011	2019
Germany	3,123	2,089
France	2,532	1,786
Poland	1,593	2,353
Czechia	1,183	435
Lithuania	403	468
Italy	390	455
Romania	335	68
Belgium	269	297
Hungary	224	179
Spain	223	145
Netherlands	206	557
Ireland	188	157
Denmark	173	131
Latvia	164	321
Slovakia	113	322
Austria	59	63
Finland	59	56
Norway	38	37
Switzerland	33	33
Estonia	32	76
Greece	21	134
Sweden	21	34
Portugal	4	5
Slovenia	1	7

Source: own processing according to Eurostat [2].

Sales of other plant protection products increased the most in Cyprus (+ 882%), Slovakia (+ 684%) and Romania (+ 339%). In

Finland the decrease was 99%, and in the Netherlands 94% (Table 5).

Table 5. Evolution of sales of other plant protection product (tons)

Country	Other plant protection products	
	2011	2019
Spain	19,421	16,225
Italy	15,443	13,417
France	2,461	905
Netherlands	1,532	96
Finland	1,311	16
Portugal	1,158	1,045
Hungary	1,135	243
Greece	733	181
Belgium	885	682
Poland	689	579
Czechia	462	258
Germany	219	204
Switzerland	91	110
Austria	58	55
Romania	30	132
Ireland	20	17
Slovenia	20	4
Sweden	11	13
Slovakia	9	70
Latvia	6	18
Cyprus	6	58
Denmark	3	9
Norway	0	9

Source: own processing according to Eurostat [2].

CONCLUSIONS

The consumption of pesticides in European countries has not decreased, even if there is more and more talk about the effects of pollution on the environment and the negative impact that their use has.

What stands out is the lack of compact data on pesticide consumption in European countries. The study was based only on information on the quantities sold.

The existence of databases to centralize data and knowledge of the quantities used could contribute to better risk management, but at the same time could be the basis for identifying strengths and weaknesses related to existing environmental policies.

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