CHEMICAL CONTROL IN AGRICULTURAL SYSTEMS FROM DIFFERENT STATES-CURRENT STAGE

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Abstract. *Chemical products are more and more frequently discussed worldwide, there are big differences between continents but also between the states of the same continent. In the present work, we have proposed to analyze their use in various agricultural systems from different countries with an emphasis on one European and one African country. The situation obtained based on the specialized literature offers a wide range of opinions about the most used types of pesticides, the percentage of application in practice, about their toxicity and last but not least about the national or continental legislation. The subsidiary purpose of the action is actually to see the tendency of reduction or increase and implicitly the harmful actions on the environment. From those analyzed, it was found that the progress in reducing the use of pesticides is uneven between the member states, depending on the socio-economic conditions and the development of sustainable agriculture. Thus, at the European level there is a clear tendency to reduce the use of pesticides (by 50%) through the European Directive on the sustainable use of pesticides, this being a target provided until 2030. In Romania in recent years, the use of pesticides has experienced fluctuations, if some pesticides were withdrawn for a while, in 2023 they were reapproved through exemptions, a fact that attracted a new increase in chemical residues, especially in vegetables and fruits. However, the reduction progress is evident despite the challenges caused by the emergence of new pests and the pressure to increase productivity. By comparison, in African countries unsustainable legislation and the lack of biological alternatives have led to an increase in the use of pesticides and exposure to toxic substances. Regardless of the agricultural system, country or status, the implementation of safer agricultural practices remains essential priorities for reducing the negative impact of pesticides.*

Keywords*: Pesticides, agricultural systems, pest, state of art*

INTRODUCTION

Pesticides by definition are chemicals used mainly to reduce or harmful animal organisms, pathogens, weeds in agroecosystems and that can negatively affect the environment and human health (ROBERTS AND KARR, 2012; KIM ET AL., 2017). Thus, depending on their target, they can be insecticides, fungicides or herbicides (RANI ET AL., 2020).

Through their use, pesticides also affect the diversity of existing species, leading to the reduction and elimination of non-target organisms (such as pollinating insects and bees) (SÁNCHEZ-BAYO, 2021).

A categorization of the percentages of global pesticide use, herbicides ranked first, with 47-53%, followed by insecticides with approximately 18-29% and then fungicides with 17-23% (FAO, 2020; TADESSE, 2017).

In Europe, in the last years, there is a tendency to reduce the use of pesticides thanks to the European Directive on the sustainable use of pesticides (2009/128/EC) and the "Farm to Fork" Strategy, aiming to reduce by 50 % of pesticide use and risks by 2030.

A holistic view suggests that EU Member States have adopted National Action Plans (NAPs) to achieve these goals, promoting the integrated use of pest management (IPM) and non-chemical alternatives (HELEPCIUC AND TODOR, 2021).

In Romania, the use of pesticides was fluctuating. In 2021, the general consumption of chemical pesticides decreased by 8% compared to 2020, but the use of very dangerous

pesticides increased by 7% between 2020 and 2021. These fluctuations reflect the challenges of Romanian agriculture, such as new pest species that require continuous use of strong pesticides. Despite these challenges, Romania has made progress towards reducing the use of chemical pesticides in general, reaching a percentage of 56% of the level from 2015-2016, close to the EU's objective of a 50% reduction by 2030 (LANTUL ALIMENTAR, 2021; REVISTA FERMIERULUI, 2021).

However, compared to 10 years ago, the consumption of pesticides has increased in Romania, being almost three times higher today compared to the previous period. This is largely attributed to the increase in agricultural productivity and the need to deal with new challenges such as newly emerging pests (REVISTA FERMIERULUI, 2023).

Even under this approach, progress in reducing pesticide use is uneven between member states, depending on socio-economic conditions and the development of sustainable agriculture. Some countries have successfully implemented significant reductions, while others are stagnant in reducing dependence on traditional pesticides (SILVA ET AL., 2021).

In Africa, although pesticides are used in a small percentage compared to the global average, (around 5% of the pesticides used globally), they mostly contain toxic or extremely toxic substances. Besides that, the application conditions are dangerous, sometimes it is done without adequate protective equipment in the context of insufficient knowledge about their correct use (WILLIAMSON, 2011).

Many farmers lack protective equipment and minimal training, which leads to dangerous exposures that endanger human health (BERTRAND, 2019).

Through this review, we want to draw attention to the current situation of the use of pesticides in various socio-economic conditions, the causes that contributed to the given situation and the future trends of efficient and sustainable management.

MATERIAL AND METHODS

As a Review, the analysis of the current situation in the specialized literature was done by consulting the existing articles as well as our own findings. The period of analysis was made starting 10 years ago and further where it was the case of exemplifications. The literature consultation was done physically but also in electronic format.

RESULTS

Discussions on the use of pesticides in different situations

From the analysis of the use of pesticides (specifically insecticides) in 2 countries, one from the European Union and 1 from Central Africa, we found big differences in approaches.

Broadly speaking, although the types of agro-horticultural crops differ, the type of pesticide and the number of applications differ. In the European country (for example, Romania) in the last 3 years, the pesticides used were from non-toxic, low or moderate categories, with some limited-term exemptions, high toxic ones under strict legislation and national and continental regulations.

In the period 2020-2024 in the protection of large crops, for example corn, cyantraniliprole was and is frequently used, a foliar insecticide in corn crops, effective against the harmful larvae of *Ostrinia nubilalis*, reducing the attack compared to untreated crops (PINTILIE ET AL., 2022). It is selective against pollinating and pollinating organisms (PINTILIE ET AL, 2021).

Another product used to combat pests in rapeseed and other crops is lambda-cyhalothrin, which has demonstrated high efficiency (APOSTOL, 2021). However, recent studies say that it is toxic for beneficial organisms and requires great attention in application (RABBANI ET AL., 2024).

Tefluthrin, which according to the information provided by the producing company is a pyrethroid with no adverse effects on the terrestrial environment, is also used in the protection of the corn crop, being applied in the fight against wireworms and the western rootworm.

Another point of view comes to draw attention to the rational use of tefluthrin and the need for increased attention due to the residual toxicity in primary and secondary cultures but also in aquatic environment (MAXIMILIANO ET AL., 2024).

In 2020, Africa imported and used significant amounts of pesticides, many of which were insecticides, to control crop pests relevant to the specific area and geographical conditions. This is also the reason why the use of pesticides increased in the immediately following period compared to previous years.

So, in the Central African Republic, in the period 2020-2024, direct studies on the insecticides used are limited and these are applicable to the predominant crops, i.e. cocoa and bananas. For example, for the treatment of specific pests in cocoa crops, including in the recent period 2020-2024, several insecticides were used, including neonicotinoids (imidacloprid + bifenthrin), against mirids, caterpillars and other pests of cocoa trees. As specification, combinations with neonicotinoids and singles can be toxic to humans and animals if not used correctly and also pose a risk of soil and water contamination. This requires strict safety measures, such as distancing the work area in case of contact (GUESSAN-BI ET AL., 2023).

Another combination used against cocoa pests is acetamiprid+bifenthrin, debatable anyway, which although in some mentions seems less toxic (WANG ET AL, 2020), however there are recent contradictions that cause environmental pollution and adverse effects on ecosystems as well as high toxicity for pollinating insects and bees (GUO ET AL, 2021). Bees and other insect pollinators are known to play a crucial role in crop pollination alongside other animal pollinators such as bats and birds (SHADEN ET AL, 2021).

By comparison, neonicotinoids have been restricted in the European Union since 2018, when their use outdoors was banned to protect pollinators, especially bees. In December 2013, the EU already imposed partial restrictions on some neonicotinoids (imidacloprid, clothianidin and thiamethoxam), and in 2018 the ban on their use in most agricultural applications was extended. Two years later, the situation was reevaluated (EFSA, 2020).

Older studies show a different situation regarding the use of pesticides, more precisely insecticides to combat pests. If in Europe the access to pesticides was high compared to Africa, 10-20 years ago, the excess use was obviously done without a clear restriction in both continents. Thus, if we were to exemplify the phytosanitary protection of corn from that period, we would find that insecticides were used for certain pests that are no longer allowed today.

Studies carried out a long time ago in the strategy to combat the invasive pest Western corn rootworm showed that the most used and effective in combating adults were thiamethoxam and fipronil and in combating larvae of this pest thiamethoxam and dimethoate (PALAGESIU ET AL., 2001; GROZEA 2003; GROZEA, 2010). Besides these, the use of natural enemies in the classical way was another option considered only at the experimental level for scientific purposes (Grozea et al., 2008).

The management of pests in general (GROZEA, 2015) and of this pest in particular in recent years has included bioinsecticides but also the use of colored and pheromonal traps (COSTEA ET AL., 2024).

In the Central African Republic, pesticide use is primarily focused on agriculture, particularly to protect vegetables and staple crops. Farmers use preventive insecticides and fungicides, often at regular intervals (every 7 days during the rainy season and every 14 days during the dry season). This practice aims to secure crops and reduce the workload of farmers. However, excessive and unregulated use of pesticides poses environmental and health risks.

From the findings of the literature analysis, it is obvious that the causes of the excess of pesticides and the damage to health and the environment are the following: 1. lack of knowledge about the potential risks to health and the environment; 2. lack of national and regional regulations; 3. unrestricted use of very toxic and extremely toxic pesticides; 4. preventive applications not based on prior monitoring; 5. non-compliance with the recommended doses; 6. repeated applications without justification; 7. not using appropriate protective equipment (Figure 1).

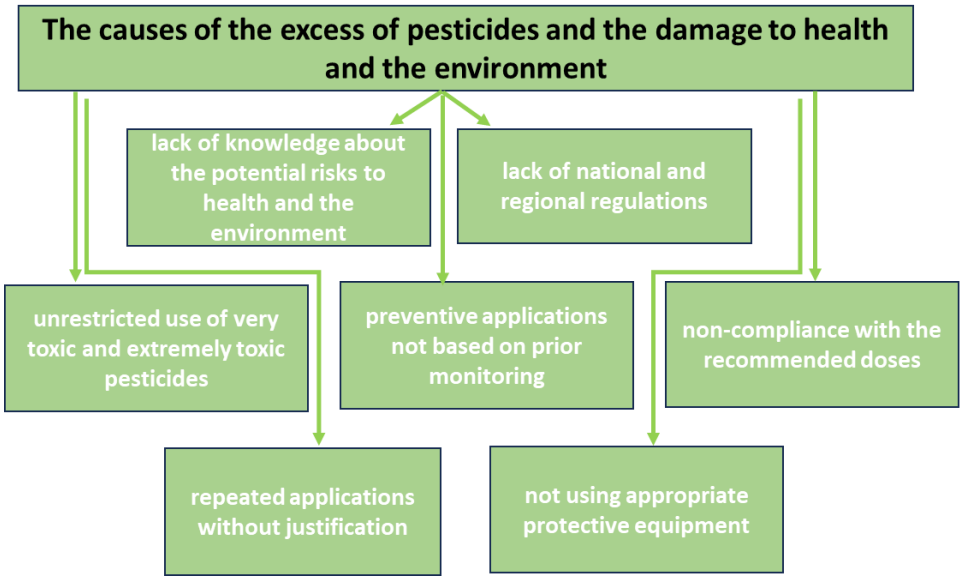

Figure 1. The causes of the excess of pesticides and the damage to health and the environment regardless of the analyzed period or region (in our point of view)

CONCLUSIONS

After analysing the situations in various geographical and socioeconomic conditions, we found that the difference is especially evident in recent years when, against the background of the expansion of the pesticide trade, their number and availability has increased. However, the absence of regulations can lead to excessive use of toxic pesticides, faulty application through repetition and increased doses, unorganized treatments and lack of protective equipment. All these have negative effects on the environment and on human health.

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