

Article

Analysis of Toxic Contaminants in Agriculture: Educational Strategies to Avoid Their Influence on Food

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Abstract: A diagnosis of the current state of the crops is made regarding the control of weeds, use of pesticides, fungicides; with an assessment of the state of the plant covers in the crop, and its control by different types of herbicides, and we detected a high loss of biological diversity; and some of these compounds are mentioned due to their high toxicity. Similarly, the use of pesticides and fungicides is discussed due to their repercussions on health. In order to avoid the unhealthiness caused by the applications of these products, phytosanitary and educational control strategies are proposed; promoting the inspection of fruit and vegetable markets, and modifying the contents in higher professional and university education. To this end, we propose an active teaching methodology, through which the student acquires skills and responsibility for the use of chemical agents in agriculture, which serves to prevent the entry of these contaminants into the food chain. Of the different polluting chemical agents, in the case of herbicides we highlight Oxyfluorfen and Glyphosate with high toxicity and whose consumption is very high. In the case of pesticides and fungicides, among others are Organochlorine compounds, which have been detected in blood, and Carbon Tetrachloride and Chloroform, considered potent hepatotoxic and neurotoxic. The basic objective of this study is the awareness and acquisition of knowledge by future teachers about polluting agents, which will subsequently have an impact on society.

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1. Introduction

Throughout history, traditional agriculture has been practised, in which knowledge was passed from father to son, migratory phenomena from rural environments to cities have ended this type of agriculture. Starting in 1970, the new agriculture was born with the appearance of new technologies and chemical products that favoured the increase in production. The new system of agricultural production has been fully accepted by the population, by achieving this mode of development the population's access to food. This is due to the use of agricultural machinery, and chemical products, such as herbicides, pesticides and fungicides. The problem is that at the same time there has not been a cultural increase in the population to counteract it, which is why it is exposed to the action of polluting agents from land, water and air. As a consequence of this fact, ecological agriculture is being developed, set by a green revolution to combine development and conservation. It is advocating for an agro-industry compatible with sustainable development, highly demanded by today's society [1].

In different types of crops, since the agricultural revolution of 1970, the so-called constituent weeds of grasslands have been studied from various perspectives, either because of their interest as plant covers that prevent erosion, and act as CO₂ (carbon

dioxide) sinks, according to Cano-Ortiz et al. and Spampinato et al. [2-4] and for its floristic diversity, even for its use as fodder for livestock. However, at this time the grasslands or "weeds" have been and are heavily attacked by farmers [1]. In the case of olive cultivation in Spain, Italy and Portugal, grasslands are studied by Cano-Ortiz in successive publications [1, 2, 5-11], which analyses the plant communities present in olive cultivation from the floristic point of view, dynamic, ecological and its use as bioindicators.

In these studies, the different agricultural techniques, tillage, semi-tillage systems and plant covers, inert or alive, and within the latter, the natural or artificial sowing systems, are revealed. Cano-Ortiz et al. [11] clearly differentiates the two great types of olive growing; sustained and sustainable, the sustained is the one that is carried out with an external contribution of energy, it is what is known as agricultural exploitation without taking conservation into account, and there is the continuous contribution of products (nutrients) for the production of the olive grove, it is about carrying out a production as high as possible with an environmental cost, and of course a high economic cost for the farmer [1].

It can practically be admitted, although not 100%, that the traditional practice of olive cultivation coincides with the sustainable cultivation of the olive tree, this being a cultural phenomenon lost in its almost entirety. When we talk about sustainability, we are talking about the ability to endure over time without detriment to natural (soil, flora and fauna) and cultural capital, such as the types of management that make production and renewal possible over time [12].

Of the different definitions given for "Sustainable Agriculture", we can choose that of the American Society of Agronomy, "*sustainable agriculture is one that in the long term improves the quality of the environment and the resources basic of that depends, brings the food and fibers necessary for humanity, it is economically viable and improves the quality of life of the farmer and of society as a whole*", in reality what the farmer seeks is to abandon the criteria of maximum production per hectare, improving the productivity of the farm, through a better management of productive factors (Figure 1). At the present time, sustainable agriculture is respectful of the environment, it can be defined as a set of scientific ecological practices, through which healthy foods are produced, which satisfy human needs and preserve natural resources [1].

For some authors traditional and sustainable agriculture are the same, it should not be treated in this sense, since traditional agriculture implies a type of knowledge acquired over millennia, and highly contrasted empirically, which is really an agricultural culture, therefore, it cannot be replaced by current organic farming practices, as it represents a very simplistic model. It can be admitted that the forms of traditional management constitute coherent eco-compatible systems, while the current sustainable cultivation is not or does not follow 100% the traditional model [13,14].



Figure 1. Cultivation of olive groves in a Mediterranean environment with vegetation cover (own photograph)

The loss of biodiversity is primarily attributed to the indiscriminate use of herbicides, pesticides, and fungicides, among other factors. Therefore, it is advisable to adopt environmentally-friendly agricultural practices such as traditional and sustainable farming methods. Both traditional and sustainable agriculture demonstrate a profound respect for the environment [1, 15].

Herbicides are chemicals used to kill or control the growth of unwanted plants (Figure 2).



Figure 2. Mediterranean olive groves treated with herbicide in which there is a high loss of floristic diversity (own photograph)

Important herbicides that can affect humans include Paraquat, Agent Orange, Glyphosate, and Organophosphates. Different types of herbicides give rise to different clinical manifestations and have different levels of toxicity [16].

Paraquat ingestion is associated with multiple organ damage within a few hours and is fatal in large quantities. Organophosphates are widely used as pesticides. Agent Orange is a very powerful herbicide that has been used in warfare and is a human carcinogen. However, Glyphosate is considered by some authors as a dangerous, highly toxic herbicide and by others as a benign herbicide that affects native flora, except for transgenic plants that are resistant to this compound, as well as bulb or tuber species, whose aerial part can dry out due to the application of herbicide, but not the buried part that becomes contaminated, to be used later by the population. Other herbicides are heterocyclic compounds that are applied to the soil, absorbed by the xylem, and can also find their way into the food chain [1, 16].

Something similar occurs with the pesticides and fungicides widely used on fruit trees and vegetables. Food and Agriculture Organization (FAO) [17] establishes that a pesticide, "is the substance or mixture of them, intended to prevent, destroy or control pests, including vectors of human or animal disease. According to the chemical structure, there are more or less dangerous ones for the human being, the most used are the Organochlorines, Organophosphates, Carbamates, Thiocarbamates and Pyrethroids, the first two being the most dangerous; whose persistence in the environment is long, in many cases for more than 3 years [18]. They are highly dangerous because they present a mortality rate higher than DL_{50} this is the case, for example, of Organochlorine and Organophosphate pesticides. Compounds in general used in agriculture, livestock, industry, home. The exposure of the human being to the three great types of contaminants; herbicides, pesticides and fungicides is constant, control mechanisms are insufficient, so ingestion through food or by inhalation causes poisoning in the population. Soil, water and air pollutants are used in different countries, always with the same consequences, the contamination of agricultural products reaches the food chain [19, 20], Castillo *et al.* [21] give

a list of 32 pesticides prohibited due to their high toxicity that contaminate crop fields, and only two can be used with a restricted nature.

Although most countries have regulations on this matter, however, despite the regulation, there are deficiencies in the control mechanisms. The EU Implementing Regulation on fruit and vegetables only talks about customs, commercial and economic controls, and only on page 130 mentions "product quality, including pesticide residues" [22], inspections are deficient and the culture of the population is low in this regard. This is reason enough to propose teaching strategies that prevent the arrival of toxic compounds to humans. Currently, within the teaching-learning processes, active learning is being favoured as the main aspect; where the student is responsible for the acquisition of knowledge. Based on this premise, we proceed to teach crop pests and weeds, and their control by chemical agents through the use of active methodologies [23, 24].

It is intended to address certain conceptual, procedural and, especially attitudinal, contents in terms of sustainable agriculture, which are not officially included in the curriculum of Biological, Environmental, Agronomy and higher professional formation. More specifically, the proposal focuses on the areas of sustainable agricultural production and agricultural techniques, as well as the use of agrochemicals, with the use of active methodologies in education, a didactic tool to address contents linked to the use of agrochemicals, grassland communities, agricultural techniques and sustainable food [23].

Due to the excessive use in agriculture of the three polluting agents; herbicides, pesticides and fungicides, the food chain is contaminated to a greater or lesser degree, and although in certain cases the amount of contaminants is within who regulations, as they are compounds that either accumulate in the body or take time to In being eliminated by this, the possibility of suffering a tumour is high. The irresponsible contamination of soil, water and biota by various chemical agents, and specifically by organochlorine pesticides that pass into the food chain, and that chemical analyses of blood and breast milk appear in pregnant women, as well as in studies of young people, with an increase in genetic malformations, according to the authors Torres and Capote [16], these same authors express the need for greater demands in educational matters.

Genetic anomalies are increasing in developing countries, where the control mechanisms for these products are insufficient or null, as is the case of certain agricultural populations (Valle Nuevo Constanza with approximately 50,000 inhabitants, Dominican Republic), where there are various types of tuber crops, in which herbicide is applied to dry the aerial part of the plant, herbicide that translocates to the tuber and the food chain (Own observations) (Figure 3) [16].

The fundamental objective of this work is to make students and society in general aware of the environmental problems of pollution, and to propose mechanisms that mitigate said pollution in the population, such as increasing the knowledge of teachers, so that they can later take it to the classroom.



Figure 3. Locality of Valle Nuevo-Constanza (own photograph)

2. Material and Methods

The present work constitutes a review of the grassland communities, known as crop weeds, their elimination by herbicides, as well as the use of pesticides and fungicides in pest control, and the possible contamination of agricultural products, made the diagnosis environmental; we analyse its possible impact on society, and we assess possible strategies to reduce the entry of these contaminants into humans.

We study the contents on polluting agents, grassland communities and agricultural techniques in the educational system, to demonstrate the lack of content. Within the proposed educational strategies, we highlight the use of two of them, depending on the level of education in which they work.

In the first case, we talk about the use of the Project-Based Learning (PBL) method, together with the Reasoned Action Teaching-Learning Strategy (RATS), serving to demonstrate its incidence and repercussion in the forms of student participation. This proposal is made for levels of education in Higher Vocational Training and at the University.

The PBL method follows the principle of meaningful construction of knowledge as an instructional strategy confirmed in several studies [25-28]; the principle of gradual development of the foundations of critical thinking, confirmed in the studies by Katz & Chard [29] on the long-term effects of incorporating project work at various ages.

In this sense, the proposal that we present here is complemented with action tools such as Teaching-learning Strategy for Reasoned Action (TSRA) in such a way that with the use of the PBL method, which maintains the characteristics of its original style, centred on students, from their immediate environment, mediated by nuclei or questions that generate knowledge and, to promote responses based on both information and the exercise of critical thinking from age-appropriate cognitive tasks, the maximum training of the student is obtained.

In any case, the learning process is innovative in terms of the way of approaching, through these methodologies and in an educational context, current and future social challenges, provoking reflection on the practice in teachers for a paradigm shift on the teaching of the centre, with the approach of the generating nucleus of knowledge of the project on sustainable agriculture.

In a second case, we propose the use of strategies such as "inverted classrooms" or "flipped classroom" for university education. In which we transfer the learning models outside the classroom and use class time, together with the teacher's experience, to facilitate and promote other processes of acquisition and putting knowledge into practice. Through this methodology, teaching is transferred outside the classroom to the field. With this, the students are able to learn from their own experience not only the recognition of crop weeds, and what crop pests and diseases are, but also how to control them with herbicides, pesticides and fungicides. And with the use of prior knowledge, they can proceed to put it into practice [30]. Different items are carried out inside and outside the classroom, with the aim of knowing the knowledge before and after teaching [31,32].

The flipped classroom model is considered an alternative to achieve competencies, being these a set of knowledge, attitudes and skills that must be acquired by students. This methodological use contributes to the achievement of these skills and brings students closer to the study of real problems, such as the contamination of agricultural products by polluting agents, for which work is done in the field on the loss of floristic diversity and the increase in the consumption of chemical products by the population.

To obtain knowledge and consequently skills on sustainable development avoiding environmental contamination, we select sample plots previously studied in 2005 by Cano-Ortiz [12], and those same plots are selected again in 2019, after having been treated with herbicides [31], to make comparative analysis of diversity. Locating each point studied in exactly the same UTM where the study was carried out in 2005, the students in 2019 make

a study of the species present in those areas; noting coverage values and abundance-dominances of the species present. For the resolution and phytosociological identification of the species, they make use of the dichotomous keys of Western Andalusia [33], as well as the use of the binocular magnifying glass in the laboratory for the identification of floristic characters (Figure 4), and a prior survey is carried out on the students (Table 1).

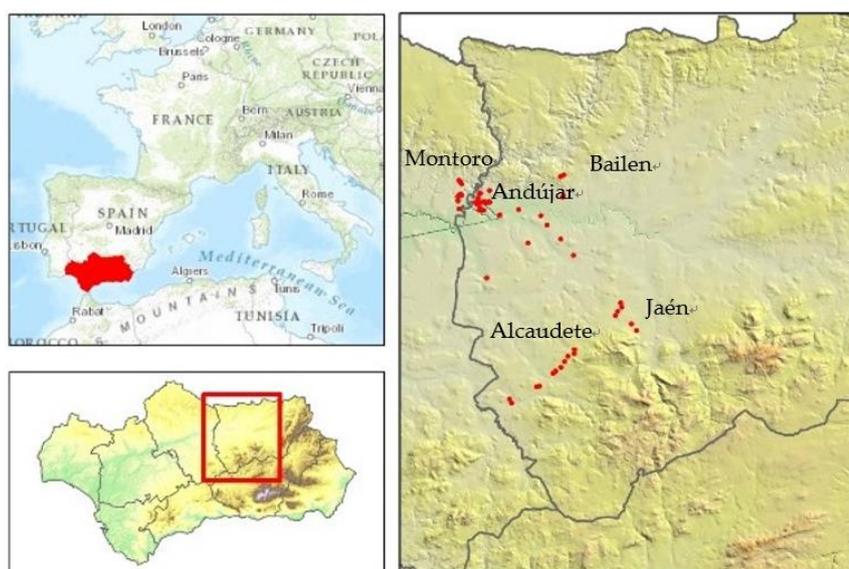


Figure 4. Location of area of study [34].

Table 1. Questions asked to students before teaching (number of students questioned 37, number of questions 14)

PRE-STUDY QUESTIONS	Indications	Percentage		Numeric	
		Answers		Answers	
		YEAH	NO	YEAH	NO
Should a well-preserved soil have an A horizon rich in plant remains?	yes/no	81	19	30	7
Do you think that a well-preserved soil should have a plant cover or not?	yes/no	65	35	24	13
Do you think that there is competition for water between the vegetation cover and the species we cultivate?	yes/no	100	0	37	0
Do you think that this competition for water would depend on the type of vegetation of our crop or not?	yes/no	0	100	0	37
Do you think that if there is no plant cover, insects disappear?	yes/no	73	27	27	10
Do you consider convenient to eliminate the vegetation of a crop with herbicides?	yes/no	73	27	27	10
Do you think that herbicides are harmful to health?	yes/no	95	5	35	2
Could herbicides get into groundwater?	yes/no	81	19	30	7
Could herbicides get into the vegetables or fruits we eat?	yes/no	95	5	35	2
Do you know of any disease caused by food contamination?	yes/no	0	100	0	37
Do you have knowledge of how agrochemicals should be used and in what concentrations?	yes/no	0	100	0	37
Do you think that you have been given enough knowledge about agriculture and sustainability from school?	yes/no	0	100	0	37
Do you consider sustainability a relevant topic for you?	yes/no	86	14	32	5
Would you propose to include their study in initial levels in education?	yes/no	86	14	32	5

3. Results and Discussion

The study of the application of chemical compounds for agricultural, industrial and domestic use leads us to consider the defence of the population against various chemical agents, mainly in the agricultural case. The study carried out on plant communities in agriculture has allowed us to know what types of herbicides and when farmers use them, incorrect types and applications of these chemical agents are detected, and consequently the contamination of soils, waters and therefore contamination of agricultural foods, this fact allows us to bring this information closer to the educational system, with the aim of raising awareness in society to obtain a healthy diet.

For this reason, it is essential to apply and expand knowledge about this type of chemical products, since 2010 the use of herbicides to eliminate weeds has increased disproportionately; the consumption of herbicides in Spain has increased gradually from 2010 to 2019, (Figures 5 and 6) going from 254.02 million euros of turnover to 370.79 million euros; being Oxifluorfen (pre-emergent herbicide), which is applied at a dose of 2-3 L/Ha and Glyphosate (post-emergent herbicide) that is applied at a dose of 3-4 L/Ha, the two chemical agents are the most used, whose toxicity is high, on a scale from I to IV, the degree of toxicity is I (highly dangerous), food contamination by these products is extremely dangerous.

Herbicides that are used to control weeds, the first thing they have to do is penetrate inside the plant, and they can do it, by two ways: root either foliar.

Heterocyclic compounds include those compounds that have heterocycles with two or three nitrogen atoms, thus we have triazines that penetrate plants through the roots, having some foliar or contact action, or translocate through the xylem when they are absorbed through the roots and inhibit photosynthesis, the formation of apical meristems and the assimilation of nitrates. The metabolization of these products in resistant plants seems to be due to the existence in plants of substances capable of hydrolysing triazines or its derivatives, the degradation in the soil is due to microbial agents, being very slow and very persistent, so it is necessary to avoid sowing afterwards.

The triazoles penetrate in the soils fundamentally by the leaves and also by the root, they quickly translocate and accumulate in vegetative reproduction structures, such as tubers, rhizomes, etc., so they should not be used, since they easily reach the food chain, they are contact herbicides that act at the metabolic level, especially on the enzymatic system, the symptoms that produce are similar to the albinism, is a herbicide that it remains latent in the plant, being his degradation in the soils of 1-2 months, the only compound of the cluster of the triazoles that have been allowed in Spain is aminotriazole, which is very effective for perennial, bulbous and rhizomatous plants. Uracils are heterocyclic compounds similar to triazines, penetrate by the estate and have a checked action residual, they quickly translocate through the xylem, act on photosynthesis and have a high permanence in the soil, either because they are adsorbed by the humus-clay complex or because degradation by microorganisms is slow [15, 34-37].

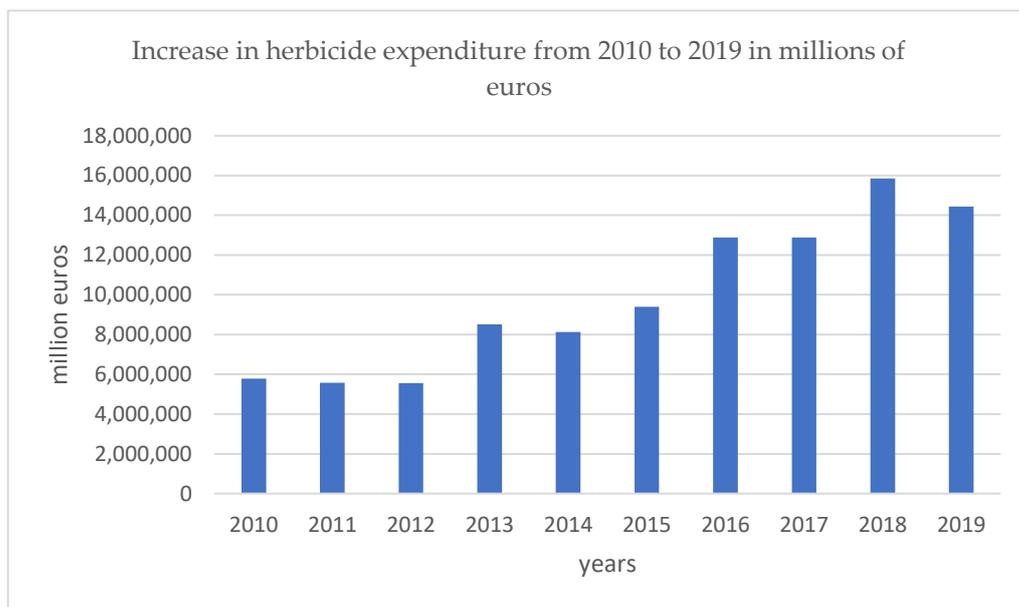


Figure 5. Increase in herbicide billing in millions of euros from 2010 to 2019 [33-15].

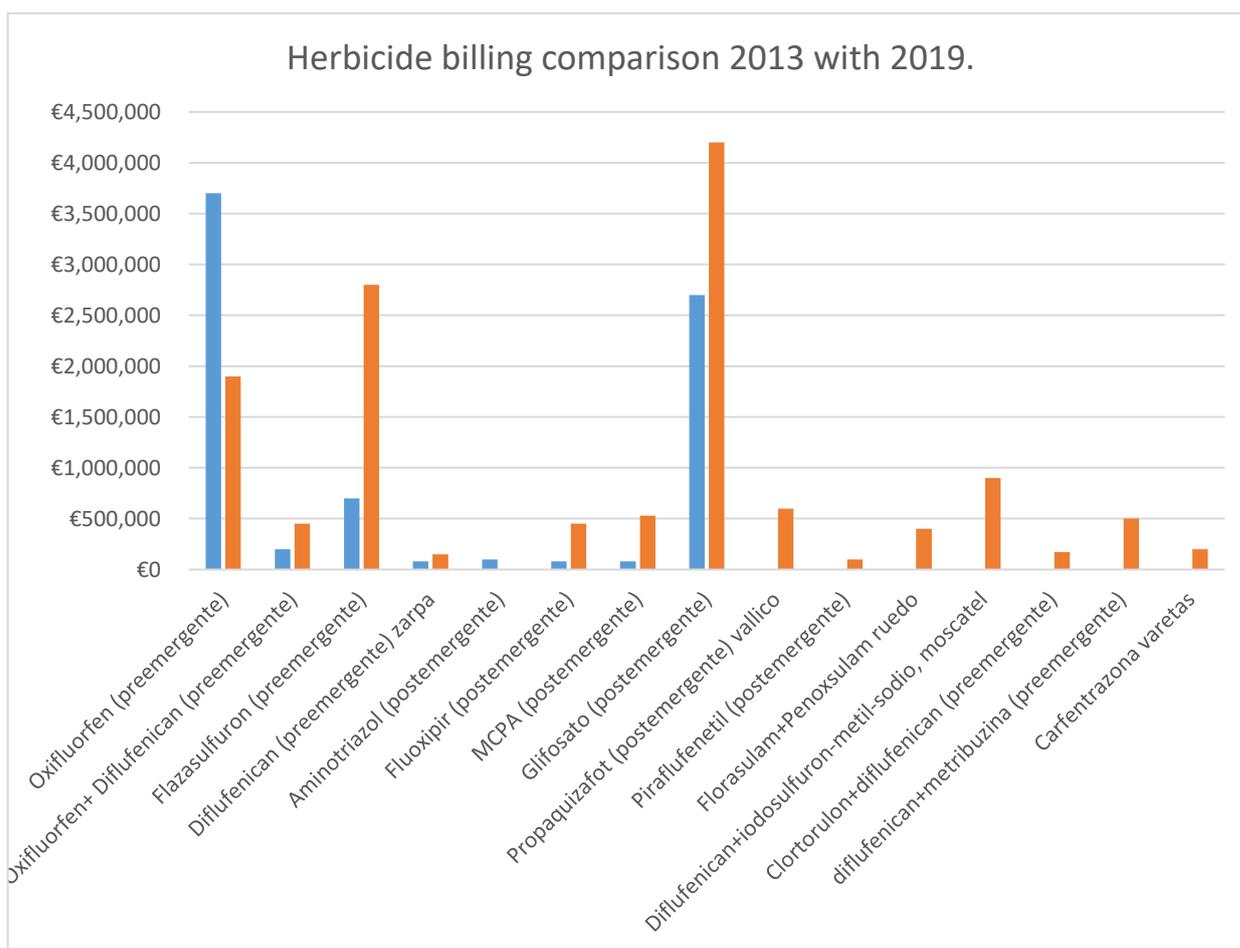


Figure 6. Comparative analysis of herbicide billing years 2013 and 2019 [15].

The comparative field analysis for the period between 2005 and 2019 clearly demonstrates the effect caused by the excessive use of herbicides. The two plots studied in 2005

by Cano-Ortiz [12] (*Papaveri-Diplotaxietum virgatae*, PD) (Figures 7 and 8) and (*Fedio-Sinapietum mairei*, FS), presented a high Braun-Blanquet floristic diversity [38], with high values of abundance-dominance of the characteristic species of the plant community (association), which had a plant cover between 90-100%. Analysing the relationship between species characteristic of the community and companions of nearby communities, a change in diversity is also observed; the trend of the plant association in 2019 is to disappear due to the loss of its own species.

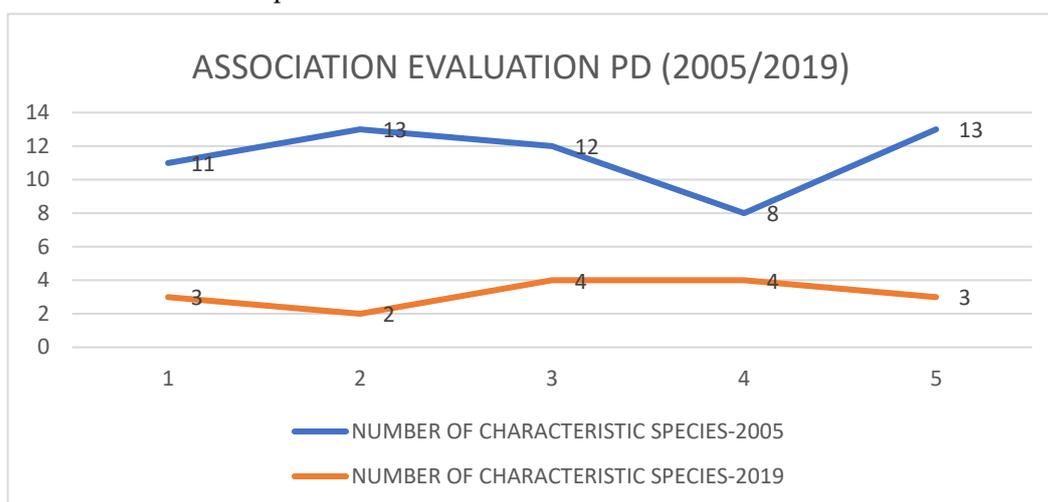


Figure 7. Evaluation of PD communities during the period from 2005 to 2019 [15].

The study carried out in those same plots in 2019 shows that there is a great loss of floristic diversity, leading to the disappearance of numerous characteristic species of the biotope, and those that still exist do so with a reduced abundance-dominance index; the indiscriminate use of chemical agents is the cause of the loss of diversity.

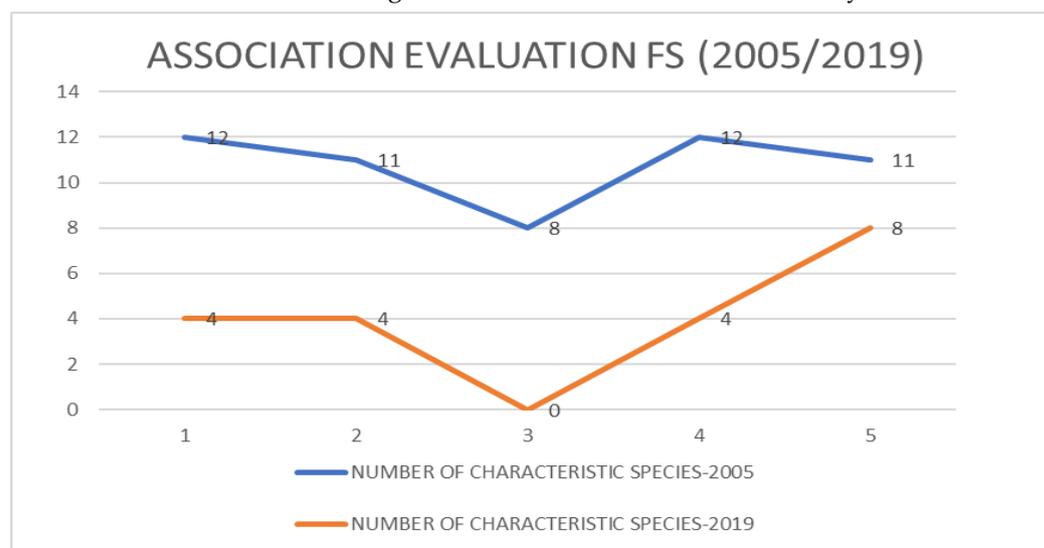


Figure 8. Evaluation of the FS communities during the period from 2005 to 2019 [15].

After mentioning the previous results of the increasing use of agrochemicals in agriculture, we will indicate the procedure regarding their teaching in Higher Vocational Training Studies (module of agriculture in vocational training of second degree) and in University. Our proposal focuses on the inclusion of new content in the subjects of Biology, Botany, Edaphology, Agronomy, Food, with a further development of university content.

The inclusion of said contents in the knowledge of the students is intended through the active methodologies exposed in the previous section [39].

According to Imbernón [40], educational innovation is defined as the attitude and process of inquiry into new ideas, proposals and contributions, carried out collectively, for the solution of problematic situations in practice, which will lead to a change in contexts, and in the institutional practice of teaching. And based on this, we propose the inclusion of the study of agricultural techniques, use of agrochemicals and sustainable food within the curricular content of students.

The Official Journal of the European Union (EU) [41] says that "Passport and Phytosanitary Certificate" must be required for the introduction and transfer of plant products, but it only refers to the transport of seeds and other plants for planting, but does not speak of polluting agents. The Ministry of Health and Social Policy (Spain) in Royal Decree 830/2010, of June 25, establishes the regulations governing training to carry out treatments with biocides; and regarding pesticides, it says that they cannot be applied by a public [42], more recently the Ministry of Agriculture, Fisheries and Food, BOE number 151 of June 25, 2021, issues Royal Decree 387/2021, of June 1, which regulates the Official Phytosanitary Certification regime, for the export of plants and plant products, and modifies Royal Decree 50/2005, of January 21, which adopts protection measures against the introduction and dissemination in the national territory and the European Community of organisms harmful to plants or plant products, as well as for export and transit to third countries [43, 44], this decree includes who is the personnel trained to issue the "Phytosanitary Certificate", Engineers Agronomists, Agricultural Technical Engineers, Forest Engineers, Forest Technical Engineers. In several ministerial orders of the Government of Spain, there is no mention of the repercussion that the aforementioned contaminants have on health. Although these personnel are trained by Spanish legislation, it does not appear that they are sufficiently qualified to assess the influence of chemical agents on human health, since the curricula of the different degrees lack this training. Based on the above, and taking into account the considerations of the International Code of Conduct in the application of chemical products [17], we make the following proposal (Table 2).

For this reason, it is essential to incorporate into the educational system subjects on nutrition and hygienic measures that minimize the intake of pesticides, fungicides, herbicides, and that allows people to know at all times if their diet is healthy or not. Being necessary to educate in a model of sustainable development, in which contaminants dangerous to health are not used, for this it is essential to use appropriate, non-aggressive cultivation techniques, through which contamination disappears and incorporates CO₂ by acting as sinkholes; what can be achieved by increasing the knowledge of the population about these techniques, with research and innovation of new botanical resources [1, 44-47].

Table 2. Content proposal for the first university training course

1st Year University Graduate Higher Biology, Agronomy, Environmental Sciences	Content
Agricultural techniques	Sustainable agriculture. Ecological agriculture. Intensive agriculture.
Agrochemicals, use and responsibility.	Herbicides and their use in relation to the phenological cycle. Organic fertilizer (compost and vermicompost).
Subscriber, use of agrochemicals	Herbicide concept. Use of organic fertilizers. Influence of herbicides on health.
Agricultural planning.	Bioclimatology and agriculture.
Vegetative covers (malherbology)	Vegetative covers in agricultural crops. Associations and their use as bioindicators. Grasslands and soil protection.

To alleviate the effect of environmental pollution on health, it is advisable to influence teaching at all levels, including research at the university and teacher training, as

well as control mechanisms for the chemical products used, avoiding the using of these chemical components, and practising sustainable, consumer-friendly agriculture, it is ultimately about using the ecosystem services that agriculture can provide [48-50]

For this we propose a modification of the classic contents, incorporating new contents, and a system of inspection of agricultural products is proposed. We analyse the different curricula, the contents at different educational levels, and we did not find specific contents related to the knowledge of agricultural contaminants, which give the student competences on how to act against unhealthy conditions, caused by these highly toxic compounds. In the control mechanisms, we propose to promote agricultural inspection both at the level of marketing and application by the farmer.

The chemical control of weeds has been the cause of herbaceous phytocoenosis modify his composition floristics, and that to the eliminate certain species, others a lot more invasive expand, often due to ignorance in the use of the herbicide, since chemical compounds have been used that are not appropriate for the species in question; however, care must be taken not to fall into the temptation of affirming that all the flora of the olive grove is disastrous and is our enemy, obviously this cannot be a battle between what we call "weeds" and man; so it would be convenient to know are bad herbs and know his behaviour botanical-ecological, for establish control mechanisms [51,52]

The consequence of practising a sustained olive growing causes deep transformations, which in many cases causes a loss of biodiversity, which is taking place in a gigantic way. In 1995, García Fuentes and Cano described some 120 plant communities and almost 1,000 plant species in olive groves, so the olive grove cannot be treated as any industrial crop, since we can affirm that the olive grove is a true ecosystem, also existing of a profuse and rich flora, a hundred vertebrates and a numerous invertebrate species. The loss of floristic biodiversity brings with it faunal losses, the biological control mechanisms are affected and the explosion of insect pests arises [53]; however, in the analysis of floristic diversity carried out by Leiva in 2021, a 50% floristic loss was revealed due to the excessive use of different chemical agents [15].

In the case of pesticides, toxicity increases when different types are mixed, which constitute a large proportion of the product, and whose effects harmful exceed frequently those of the active ingredient itself; such is the case of carbon tetrachloride and chloroform, considered potent hepatotoxic and neurotoxic. Commercialized pesticides also contain other highly toxic chemical elements, such as dioxins from some herbicides of the Chlorophenoxy type, the Ethylenethiourea in fungicides of the Ethylenebisdithiocarbamate type either he Isomalathion in the Malathion according to Ramirez and Lacasaña [18].

It is known that polluting agents enter the food chain through fruits, tubers, bulbs, vegetables, milk and meat. The tubers and bulbs are contaminated fundamentally with herbicides applied to the soil, this is the case of potatoes, onions, garlic, asparagus; in the latter case it occurs because contact herbicides are applied to kill weeds, which do eliminate them, but do not affect the asparagus plant *Asparagus acutifolius*, *A. albus*, *A. officinalis*, species that become resistant; the collected shoots are contaminated and pass into the food chain, in the case of tubers and bulbs they are contaminated by treatment of the flora with translocation herbicides (Figure 9).



Figure 9. Roll of an olive tree treated with herbicide where *Asparagus* becomes resistant

Pesticides and fungicides usually pass through the chain through fumigation, and fruit collection without maintaining the minimum time necessary for the degradation of the chemical product. The application of these chemical products is usually carried out by farmers, whose cultural level is low, so there is no awareness about the danger of the product used, which is enhanced by a low inspection in the markets. On the other hand, the low level of botanical knowledge of the population means that they do not identify in which parts of the fruit the polluting agent accumulates, and for example, the population continues to eat fruits with epidermis, since the fruits have a layer of cells of epidermis that make up the cuticle, which is a barrier to chemical agents, it is in the epidermis where there is a greater amount of chemical agent, hence the need to abandon the old tradition of eating fruit with epidermis.

At present there is a certain rejection in the educational system of the knowledge of Botany, Zoology and Ecology, with very poor or even non-existent teaching on food in the Centres. Given this situation, it is necessary for Government Institutions to promote environmental and food issues in the Teaching Centres. Cano-Ortiz in various works tries to bring the teaching of Botany to the classroom [54-57]. In the case of Spain, BOE number 5 of January 5, 2007, includes Royal Decree 1631/2006, of December 29, which establishes the minimum teachings corresponding to Compulsory E; This Royal Decree talks about the contents on the environment, in terms of pollution and water resources, which gives the student competence in knowledge and interaction with the physical environment, as well as competence in mathematics and linguistics [58, 59], clearly insufficient regulations, since linguistic competence refers to the Spanish language, not taking scientific terminology into account, nor does the student acquire competences regarding the current profound environmental changes. More recently the BOE number 3 of January 3, 2015, by which the basic teachings are established; although the contents of Biology and Geology are collected in some depth, no reference is made to serious environmental problems or nutrition; such as the loss of biological diversity due to the excessive use of herbicides, pesticides and fungicides, as well as the entry of these compounds into the food chain.

It is essential that all institutions, public and private, undertake education and teaching about the loss of biological diversity and food contamination due to the excessive use of chemical products, by strengthening the educational system and strong food inspection.

4. Conclusions

Current research on grassland communities (weeds) and their control by herbicides, as well as the use of pesticides and fungicides in agriculture, is conclusive in terms of the loss of floristic diversity, existence of resistant species such as bulbous species and with tubers, originating the contamination of fruits and vegetables, which together with a low cultural and educational level in the population, allows us to propose the modification of

the teaching contents, in different educational levels, and especially in the university environment, incorporating contents of Botany, Environmental Chemistry, Nutrition and Health. For the teaching of these contents we propose the use of active methodologies within the learning of complex concepts, it is shown that a better assimilation and knowledge of these is generated, through its implementation. The use of PBL, as well as the flipped classroom, is useful for this, applied to different educational levels and respecting the learning pace of each student. Being able to increase their interest in what they have learned. With this proposal, knowledge of the use of phytosanitary products responsibly will be increased, thereby minimizing their impact on health.

In this study we demonstrate the increase in the use of polluting chemical agents, which is visualized by the increase in billing. Being the highest billing between 2016 and 2019, and glyphosate is the most used by the population, causing a high loss of floristic diversity. Likewise, it demonstrates the null education within the educational centres in environmental contents, such as contamination by agrochemicals and the transmission of these to the food chain. Resulting in the proposal for the inclusion of curricular content in university and non-university education.

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