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RESEARCH ON WINTER WHEAT, CORN AND SUNFLOWER CROPS PROTECTION IN ILFOV COUNTY RESPECTING NATIONAL LEGISLATION

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Abstract

Plant health (in this case winter wheat, corn and sunflower crops) is fundamental to the sustainability and competitiveness of agriculture, food safety and environmental protection. Currently, modern winter wheat, corn and sunflower *crop protection strategies are focused on combating harmful organisms (diseases, weeds and pests) that cause quantitative and qualitative losses to these crops. The research in this paper focused on the presentation of all plant protection products applied to wheat, corn and sunflower crops by 50 farmers from Ilfov county in the 2019 agricultural year. The assortment of fungicides, insecticides and herbicides used is extremely varied. We also made observations in the field to identify which diseases and pests were present in the crops and consulted the farmers on the extent of their control. The degree of attack of powdery mildew, two weeks after the application of the treatments, was calculated based on the incidence and severity of the diseases. The diagnosis of diseases was made by visual observation of the typical symptoms of their manifestations. Information from farmers was obtained on the basis of questionnaires. Total control of weeds in farmers' crops was provided by an assortment represented by 8 wheat herbicides, 2 sunflower herbicides and 10 maize herbicides. Due to environmental concerns and concern for human health, the application of products for the protection of wheat, corn and sunflower crops was done taking into account good practices in the context of promoting integrated management of diseases, weeds and pests according to European directive 2009/128/EC.*

Key words**:** *plant healt, diseases, weeds, pests, crops protection products, wheat, corn, sunflower*

INTRODUCTION

Agricultural production, which also includes the cultivation of wheat, corn and sunflower, constitutes the main activity of the rural society. This production, however efficient it may be, cannot be obtained without the activities of prevention and control of diseases, weeds and pests that agricultural crops face.

In Romania, according to Baicu and Săvescu (1986) [2], with all the progress made regarding varieties and hybrids, culture technologies, prevention and control methodologies, the damage caused by diseases, weeds and pests, in the years favorable to these bioaggressors, is quite high. Thus, wheat losses caused by diseases are approx. 11%, pests get 10% and weeds 12%. In corn, the losses caused by diseases are approx. 9%, pests get 14% and weeds 13%. In sunflower, each of the three categories of bioaggressors causes 10% losses.

Worldwide, it is estimated that the losses caused by diseases and pests are approx. 30-40% of agricultural production (Guest, 2017) [13].

Plant protection in the current context (use of as few chemical products as possible to avoid environmental pollution) is more and more acute.

Chemical control is still an indispensable method in the effective protection of wheat, corn and sunflower in Romania against diseases, weeds and pests.

Crop inspection during the growing season for diseases, weeds and pests is of particular importance in their management (Zală et al., 2023) [29].

The potential losses recorded in agricultural crops in the absence of the use of plant protection products far exceed their value.

Plant protection products (PPPs) are substances in various conditioning forms used for the protection of agricultural crops against diseases, weeds and pests, and which sometimes help the process of plant growth and development and are indispensable in agricultural production (Strassemeyer et al., 2017; Tudi et al., 2021) [21, 23].

PPPs may contain one or more active substances. Any active substance must be approved at the level of the European Union, and then plant protection products are authorized by the member states.

Plant protection products can be used by professionals and individuals, because thei are indispensable in agricultural production (Bernardes et al., 2015; Lamichhane, 2017) [5, 14].

The sustainable use of plant protection products, in the sense of the provisions of the Government Emergency Ordinance no. 34/2012 [10] for the establishment of the institutional framework for action for the purpose of the sustainable use of pesticides on the territory of Romania, approved by Law no. 63/2013 [15]., represents an essential objective for obtaining a sustainable agricultural production, and implicitly, for ensuring a competitive agricultural system at the European and international level.

Crop protection measures for winter wheat, corn and sunflower have the potential to contribute to the wider objective of ensuring economic, ecological and social sustainability of primary production.

Wheat, corn and sunflower production play a critical role in achieving sustainable and competitive agriculture sectors and the protection of biodiversity and ecosystems. Therefore, keeping plants healthy is not only important, it is absolutely vital [11].

Farmers have every interest to monitor the health of the crops in order to notice in time the appearance of dangerous weeds, pests or diseases, whose presence in the ecosystem of wheat, corn and sunflower slows down the development of the plants and generally damages the quality and quantity crops.

In Romania, phytosanitary legislation (from 2000 to the present) consists of 2 ordinances (OG 136/2000, OUG 201/2008), 4 laws (214/2001, 37/2006, 93/2007, 165/2009); 24 orders (560/2002, 912/2004, 653/2006, 585/2007, 586/2007, 698/2007, 686/2007, 378/2007, 387/2007, 583/2007, 579/2007, 580/2007); and 13 decisions (1135/2007, 1085/2008, 441/2009, 107/2009, 1566/2009, 259/2010, 5/2011, 352/2014, 810/2014, 1030/2014, 563/2007, 19/ 2018, 599/2019).

Weeds are unwanted plants that must be fought because they compete with crops for different resources: light, soil nutrients, water and growing space (Botha, 2001; Budoi et. al., 1994) [6, 7].

By their nature, weeds grow and multiply faster than agricultural crops, and due to the fact that their seeds remain in the soil for several years, they have a short lifespan, with several generations in the same growing season, they cause quantitative and qualitative damage to the harvest (Berca, 2004; Saupe, 2009) [4, 18].

Production losses in the wheat crop due to weeds can be 20-40% (Ahmad and Shaikh, 2003) [1].

Maize and sunflowers are strongly weeded regardless of the area in which they are grown because the nutrition space is wide and allows that in the first phenophases of development the crops are attacked by numerous weed species that are favored by the sunlight that falls directly on the soil , as well as the humidity that is usually sufficient for seed germination (Berca and Ciorlăuș, 1994; Courtney, 1996) [3, 9].

Production losses in the corn crop due to weeds reach 16-40% (Valverde et al., 1995) [24].

In the sunflower culture, weeds cause great damage, and production losses reach up to 60-90% [26].

At the national level, the area cultivated with grain corn in 2019 represents 47.9% of the area cultivated with grains for grains, and that cultivated with wheat 38.8%. In Romania, the area cultivated with corn was 2,599,000 ha. (with an average production of 6,524 kg/ha.), that with wheat was 2,106,000 ha. (with an average production of 4,687 kg/ha.), and that with sunflowers was 1,306,000 ha. (with an average production of 2,642 kg/ha.)

In 2019, Romania ranked first among the member states of the European Union in terms of cultivated area and production of grain corn and sunflower [17].
In Ilfov county, the highest corn production, 10,590 kg/ha., was achieved by farmer Daniel Drăghici with hybrid P0023.
In sunflower, the farmer Cosmin Iancu obtained 4,060 kg/ha with the hybrid P64LE136.
In this context, this research paper is focused on the presentation of all plant protection products applied to wheat, corn and sunflower crops by 50 farmers from Ilfov county in the 2019 agricultural year.

MATERIALS AND METHODS

Among the working methods was the opinion poll, which is based on a questionnaire (Shapiro, 2001) [19].
Visual observation is the fastest method for identifying diseases of wheat, corn and sunflower based on the typical symptoms shown by the infected plants, as well as for identifying pests and weeds present based on their morphological characters. 100 plants were noted in 4 points for each of the variants with fungicides and insecticides applied to wheat.
The degree of attack of powdery mildew and septoria leaf blotch on wheat, two weeks after the application of different fungicides, was calculated based on the incidence (frequency) and severity (intensity) of the diseases. Integrated weed control measures on a farm take into account their mapping.
The mapping of weeds in the wheat culture is performed a few days before the application of herbicides; while for corn and sunflower crops, it takes place 4 weeks before harvest (Chirilă, 1989) [8].
All treatments were applied respecting European directive 2009/128/EC [12].

RESULTS AND DISCUSSIONS

In 2019, we conducted a study among 50 small farmers, large crop growers, from Ilfov county, regarding the products used for the protection of sunflower, corn and wheat crops against diseases, weeds and pests.
From the questionnaires completed by these farmers, regarding the fungicides intended for seed treatment, they have Maxim XL 035 FS (5 l/t) and Apron XL 350 ES (3 l/t) for sunflowers and Maxim XL 035 FS (3 l/t) for corn; the seed being bought already treated.
Sunflower seeds are treated to protect them against fungi: *Sclerotinia sclerotiorum*, *Botrytis cinerea*, *Phomopsis* ssp. and *Plasmopara halstedii*, while the treatment of corn seeds was applied against the fungi *Sporisorium reilianum*, *Fusarium* spp. and *Penicillium* spp. [16, 22].
Against the corn and sunflower maize leaf weevil (*Tanymecus dilaticollis*), the seed was treated centrally with Nuprid® AL 600 FS (8 l/t), thanks to the derogation received by our country from the European Commission directive no. 485/2013 restricting imidacloprid. As treatment for wheat seed, the fungicides used were: Amiral Proffy 6 FS dose 0.5l/t (8%), Rancona 15 ME dose 1l/t (4%), Rancona I-Mix dose 1l/t (5%), Difend 2l/t (24%), Difend Extra dose 2l/t (30%), Systiva 333 FS dose of 1.5 l/t (19%), Celest Extra dose of 2 l/t. (10%) against the fungi *Fusarium* spp., *Tilletia caries*, *T. controversa*, *Parastagonospora nodorum* and *Ustilago* spp. (Figure 1).

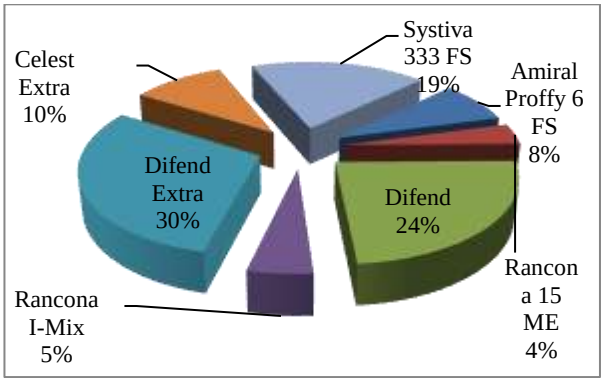

Fig. 1. Fungicides used for the treatment of wheat seeds
Source: Own design and calculation.

All surveyed farmers applied Signal 300 ES as an insecticide for the treatment of wheat seeds at a dose of 2.5 l/t.
The seeds can be treated ahead of time or a few hours before sowing.

The treatment applied to the seeds has the role of protecting the young plant from possible infections on the surface and inside the seeds as well as in the germinative zone.

Regarding the autumn wheat herbicide for the problem weed species *Avena fatua* and *Apera spica-venti*, 60% of the farmers surveyed applied one of the herbicides Bizon, Axial One, Foxtrot 69 EW or Pallace 75 WG (Table 1.). They herbicided in the development phase BBCH 23: 3 detectable tillers (Zadoks et al., 1974) [27].

Table 1. The number of farmers who weeded in the fall

The herbicide applied	Dosage (l, kg/ha)	Number of farmers	The time of application
Bizon	1.0	3	BBCH 11-23
Axial One	0.75-1.0	13	BBCH 11-39
Foxtrot 69 EW	0.9-1.1.0	4	BBCH 11-23
Pallace 75 WG	0,25	10	BBCH 12-32

Source: Own research.

In the spring of 2019, we reported, at a single farmer, the presence of downy mildew (*Plasmopara halstedii*)on sunflowers in the phenophase of 6 pairs of leaves-BBCH 16 (Weber and Bleiholder, 1990)[25].

Pale green or greenish-yellow spots appeared on the upper side of the leaves of the infected plants, starting from their base towards the tip, occupying an important surface of the leaf, and on the lower side, strictly proportional to the chlorotic areas on the upper surface of the leaf, distinguish a white, dense fluff (Photo 1.), composed of sporangiophores and sporangia of the oomycete (Zală, 2014) [29].

Photo 1. Sunflower plant with downy mildew attack
Source: Original (Lipianu, S).

Because of this, biomass production of vegetative and generative parts is drastically reduced (Spring et al., 1991) [20].

To stop the downy mildew attack, we recommended the emergency application of the fungicide Electis 75 WG (mancozeb 68.5% + Zoxamid-hexamethylenetetramine 8.8%) - 1.5 kg/ha.

On sunflowers, we also noticed the presence of dark brown spots on the leaves, of an irregular shape, arranged mainly towards the tip, typical of septoria leaf spot, caused by the *Septoria helianthi* fungus (Photo 2).

Common rust (*Puccinia sorghi*) appeared sporadically in corn, through blackish pustules (Photo 3) full of teliospores.

These diseases were not economically important.

Photo 2. Septoria leaf spot

Photo 3. Common rust
Source: Orig. (Lipianu, S.).

Treatments against foliar diseases were applied to wheat, among which powdery mildew-*Blumeria graminis* f.sp. *tritici* and septoria leaf blotch-*Zymoseptoria tritici* (Photo 4); of pests (especially against bedbugs and aphids; as well as for weed control.

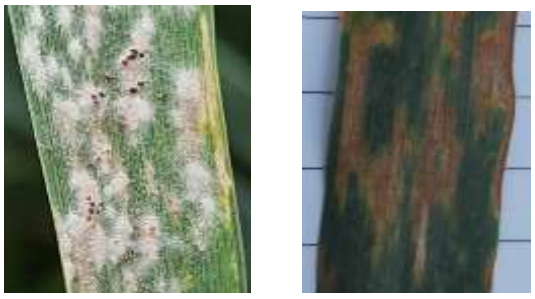

Photo 4. Wheat leaves with powdery mildew (left) and septoria leaf blotch attack (right)
Source: Original (Lipianu, S.)

The various fungicides and insecticides used by farmers to wheat can be found in Table 2.

We found that the assortment was represented by 6 fungicides and 4 insecticides.

Table 2. Fungicides and insecticides used for wheat

Category	Trade name	Dosage (l or kg/ha)	Farmers who applied treatments (%)
Fungicides	Nativo 300 SC	1.0	100
	Falcon Pro	0.6	
	Zantara 216 EC	1.0	
	Evolus	1.0	
	Zakeo Xtra	0.5	
	Prosaro 250 EC	0.75	
Insecticide	Decis Expert 100 EC	0.0625	100
	Mospilan 20 SG	0.1	
	Vantex 60 EC	0.08	
	Alfadone 10 EC	0.1	

Source: Own research.

In wheat, 23 farmers applied a number of three treatments to combat harmful agents, 21 farmers performed two treatments and only 6 farmers applied a single treatment.
The frequency of plants with powdery mildew symptoms after two weeks from the application of fungicides varied between 8.25% in the plots with Nativo 300 EC and 11.5% in the plots with Prosaro 250 EC (Fig.2).

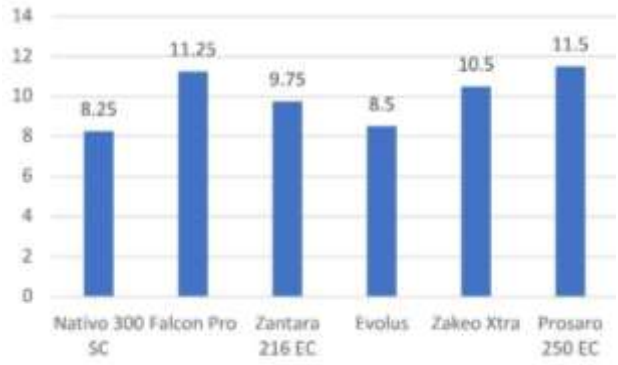

Fig. 2. Frequency of plants with powdery mildew symptoms
Source: Own research results.

The intensity of plants with powdery mildew symptoms after two weeks from the application of fungicides varied between 10.3% in the plots with Zakeo Xtra and 12.7% in the plots with Falcon Pro (Fig. 3).

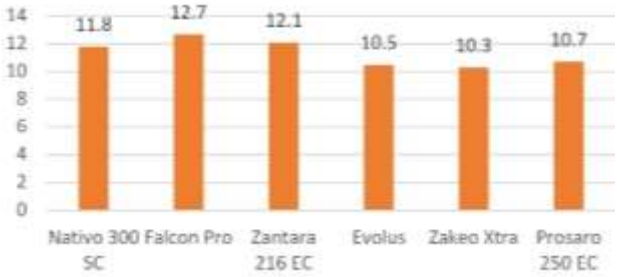

Fig. 3. Wheat powdery mildew intensity values
Source: Own research results.

The degree attack of powdery mildew varied between 0.9% in the plots treated with the Evolus fungicide and 1.43% in the plots treated with falcon Pro (Fig. 4).

Fig. 4. Degree attack on powdery mildew
Source: Own research results.

After inspecting the plots with wheat, 3 days after the application of the treatments with the various insecticides, we found the presence of only 2.4 aphids/plant in the plots where Decis Expert 100 EC was applied; 1.9 aphids/plant in the plots where Mospilan 20 SG was applied; 2.1 aphids/plant in plots where Vantex 60 EC was applied and 2.6 aphids/plant in plots where Alfadone 10 EC was applied.
Regarding the presence of bed bugs, their density was below 1 larva/m^2.
The assortment of herbicides applied to combat wheat weeds by the interviewed farmers consisted of 8 herbicides. The favorable influence of the application of different herbicides to wheat, regardless of the number and density of weed species, was manifested by a total control of them in the plots monitored after 3 weeks from the herbicide (Table 3).

Table 3. The result of applying herbicides to wheat

Herbicide	No weeds/m^2 before herbicide	% weed destruction
Granstar Super 50 SG	389.4	100
Concordia 306 SE	422.8	
Alliance 660 WG	455.1	
Rival Top 20 SG	374.1	
Floramix	295.7	
Harmony 50 SG	390.5	
Trimmer 50 WG	435.3	
Omnera	403.2	

Source: Own research results.

Regarding sunflower weed control, 17 of the farmers used Pulsar Plus-1.5 l/ha, which means they opted for Clearfield Plus production technology.
The other 33 farmers questioned applied Express™ 50 SG – 30g/ha herbicide resistant sunflower hybrid cultivation technology.
Thanks to these technologies chosen for weed control, when the sunflower plots were inspected, one month before harvest, they were free of weeds.
All surveyed farmers applied herbicides to maize. Depending on the spectrum of weeds they are dealing with, most of them, 47 of them, chose to apply two weedicides each (pre-emergence and post-emergence) and only three of them applied a single post-emergence weedicide.
The range of herbicides that ensured the farmers weed-free fields, as we could observe one month before harvest, can be found in Table 4.

Table 4. Herbicides used, target weeds and timing of application

Herbicide	Dosage (l, kg/ha)	Weeds combated	Application time
Elumis	2.0	Monocotyledonous and dicotyledonous annual and perennial	BBCH 12-18
Pyxides	0.6		BBCH 12-19
Arigo	0.33		BBCH 12-14
Equip	2.0	Monocotyledonous annual and perennial and dicotyledonous annual	BBCH 12-14
Principal	0.09		
Mustang	0.6	Dicotyledonous annual and perennial	BBCH 14-16
Adengo 465 SC	0.4	Monocotyledonous and dicotyledonous annual	BBCH 12-13
Laudis OD 66	2.0		BBCH 12-18
Efica 960 EC	1.5	Monocotyledonousannual and some dicotyledonous annual	Preemergence
Dual Gold 960 EC			

Source: Own research results.

CONCLUSIONS

Currently, due to the preparation form and the high quality of the products intended for seed treatment, they are easily applied and the distribution on the surface of the seeds is uniform; the germination capacity of the seeds is not affected. Accurate diagnosis of diseases, pests and weeds in wheat, corn and sunflower crops is the main activity in managing the problems induced by these bioaggressors.
The application of fungicides against wheat powdery mildew had a very good result, so that the degree of attack of this mycosis had very low values in all treated plots. All surveyed farmers applied phytosanitary treatments against diseases, weeds and pests to wheat, corn and sunflower crops, they used high quality products because they wanted this quality to be reflected in production.
Regardless of the number and density of weed species whose variation from one plot to another can be influenced by different factors (soil water supply, previous crop, crop density, etc.), the application of herbicides to wheat caused their total destruction .
Losses caused to wheat, maize and sunflower crops by diseases, weeds and pests are a major problem anywhere in the world, and for this reason measures must be taken to ensure high and quality yields to reduce rural poverty and increasing security food. The protection of wheat, corn and sunflower crops against diseases, weeds and pests is required as an important sequence of the integrated technological system of their cultivation. Accurate knowledge of the weed structure of all plots is an important link in integrated weed control

REFERENCES

[1]Ahmad, A., Shaikh, A.S., 2003, Common Weeds of Wheat and Their Control. Pakistan Journal of Water Resources, Vol.7(1): 73-76.
[2]Baicu, T., Săvescu, A., 1986, Systems for integrated combat of diseases and pest by crops (Sisteme de combatere integrată a bolilor și dăunătorilor pe culturi) Ceres Publishing House, București, pp. 10-12.
[3]Berca, M., Ciorlăuș, A., 1994, Weeds- an undoubted scourge of agriculture (Buruienile-un flagel indubitabil al agriculturii) 9th Symposium of the Romanian

Society for the weeds study and combat, Constanţa: 11-15.
[4]Berca, M., 2004, Weeds integrated management (Managementul integrat al buruienilor*)*, Ceres Publishing House, București, pp. 20-27.
[5]Bernardes, M.F.F., Pazin, M., Pereira, L.C., Dorta, D.J., 2015, Impact of Pesticides on Environmental and Human Health. In Toxicology Studies—Cells, Drugs and Environment; IntechOpen: London, UK, pp. 195–233.
[6]Botha, C., 2001, Common weeds of crops and gardens in Southern Africa. Agricultural Research Council, Potchefstroom. 384 pp.
[7]Budoi, Gh., Oancea, I., Penescu, A., 1994, Applied herbology (Herbologie aplicată), Ceres Publishing House, București, pp.7-10.
[8]Chirilă, C., 1989, Weeds mapping fron agricultural crops (Cartarea buruienilor din culturile agricole). Technical agricultural propaganda Publishing House (Redacția de propagandă tehnică agricolă)., pp.26-28.
[9]Courtney, A.D., 1996, Theory and practice of using the weeding thresholds (Teoria și practica folosirii pragurilor de îmburuienare). 10th Symposium of the Romanian Society for the Weeds study and combat (Simpozionul 10 al Societăţii Române pentru Studiul şi Combaterea Buruienilor), Sinaia: 265-273.
[10]Emergency Ordinance no. 34 of 27 June 2012 for setting up the institutional action framework for the sustainable use of the pesticides on the territory of Romania.
[11]European Commission, Cordis, Europa, Plant health: protecting plants to safeguard our future, https://cordis.europa.eu/article/id/413320-plant-health-protecting-plants-to-safeguard-our-future, Accessed on April 20, 2023.
[12]European Parliament, 2009, Directive 2009/128/EC of the European Parliament and of the Council of 21 October 2009 for establishing a framework for Community action to achieve the sustainable use of pesticides, https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:309:0071:0086:en:PDF#:~:text=This%20Directive%20establishes%20a%20framework,non%2Dchemical%20alternatives%20to%20pesticides., Accessed on April 20, 2023.
[13]Guest, D.I., 2017, Plant Pathology, Principles. Editor(s): Brian Thomas, Brian G Murray, Denis J Murphy, Encyclopedia of Applied Plant Sciences (Second Edition), Academic Press, pp. 129-136.
[14]Lamichhane, J.R., 2017, Pesticide use and risk reduction in European farming systems with IPM: An introduction to the special issue. Crop. Prot. 97: 1-6.
[15]Law 63 of 21 March 2013 regarding the approval of the Emergency Ordinance of the Government no. 34/2012 for establishing the institutional framework of action for the sustainable utilization of pesticides on the territory of Romania.
[16]Marcoser.ro, Products, Pesticides, Plant protection, Fungicide, shttps://www.marcoser.ro/produse/pesticide-protectia-plantelor/fungicide/apron-xl-350-es.html, Accessed on April 20, 2023.
[17]National Institute of Statistics, Press Release No. 85/ 31 March 2020, Vegetak production for the main crops in the year 2019, https://insse.ro/cms/sites/default/files/com_presa/com_pdf/prod_veg_r19_0.pdf, Accessed on April 24, 2023.
[18]Saupe, S.G., 2009, Plant Foraging: Two Case Studies. https://employees.csbsju.edu/ssaupe/biol327/Lecture/Plant_Foraging_case_study.pdf, Accessed on February 15, 2023.
[19]Shapiro, R.Y., 2001, Polling, Editor(s): Neil J. Smelser, Paul B. Baltes, International Encyclopedia of the Social & Behavioral Sciences, Pergamon, pp.11719-11723.
[20]Spring, O., Benz, A., Faust, V., 1991, Impact of downy mildew (*Plasmopara halstedii*) infection on the development and metabolism of sunflower. Zeitschrift fur Pflanzenkrankheiten und Pflanzenschutz, 98(6):597-604.
[21]Strassemeyer, J., Daehmlow, D., Dominic, A., Lorenz, S., Golla, B., 2017, SYNOPS-WEB, an online tool for environmental risk assessment to evaluate pesticide strategies on field level. Crop. Prot. 97: 28–44.
[22]Syngenta.md, Product, Crop protection, Seed treatment, https://www.syngenta.md/product/copprotection/tratament-samanta/maxim-xl, Accessed on April 20, 2023.
[23]Tudi, M., Ruan, D.H., Wang, L., Lyu, J., Sadler, R., Connell, D., Chu, C., Phung, D.T., 2021, Agriculture Development, Pesticide Application and Its Impact on the Environment. Int. J. Environ. Res. Public Health 2021, 18, 1112: 1-23. https://doi.org/10.3390/ijerph18031112
[24]Valverde, A., Muzaik, A.N., Wise, R.F., 1995, Loss in productivity of maize by weeds. Weed Survey series, Agriculture Canada. Res., 88: 2.
[25]Weber, E., Bleiholder, H., 1990, Erläuterungen zu den BBCH-Dezimal-Codes für die Entwicklungsstadien von Mais, Raps, Faba-Bohne, Sonnenblume und Erbse - mit Abbildungen. Gesunde Pflanzen. 42: 308-321.
[26]Wikifarmer, Weed management in sunflower farming, https://wikifarmer.com/weed-management-in-sunflower-farming/, Accessed on April 24, 2023.
[27]Zadoks, J.C., Chang, T.T, Konzak, C.F., 1974, A Decimal Code for the Growth Stages of Cereals, Weed Research14:415-421.
[28]Zală, C.R., 2014, Phytopathological Atacks, 2nd Ed., Didactic and Pedagogical Publishing Houes, Bucharest (Atlas fitopatologic, ediția a doua. Ed. Didactică și pedagogică, București), pp. 60.
[29]Zală, C.R., Cotuna, O., Paraschivu, M., Istrate, R., Mali-Sanda Manole, M.S., 2023, Research on the effectiveness of some fungicides and insecticides in combating of some diseases and pests of rape in Cristian commune - Brașov county. Romanian

Agricultural Research, no. 40, 2023, First Online: February, 2023. DII 2067-5720 RAR 2023-107.