Fruit Growing Research, Vol. XLI, 2025 DOI 10.33045/fgr.v41.2025.16
https://publications.icdp.ro/index.php

PRINCIPALELE BOLI ALE PĂRULUI ȘI POSIBILITĂȚILE DE COMBATERE CU FUNGICIDELE ACTUALE
PEAR DISEASES AND POSIBILITIES TO CONTROL THEM USING ACTUAL FUNGICIDES

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Abstract

Pear crop is very important of the national and European horticulture as well, Romania is holding the 9th place as regard the pear production (~46.000 t /year) and the 10th place planted surfaces (3.230 ha) (FAOSTAT, 2025). Soils diversity, climate changes and different level of the applied technology are favorable for the strike of various pest and diseases. Among the most damaging apple diseases are fire blight - *Erwinia amylovora*, pear scab - *Venturia pyrina*, brown spot - *Diplocarpon mespili, leaf spot - Mycosphaerella pyri,* brown rot - *Monilinia fructigena* and apple collar rot - *Phytopthora cactorum,* which, in absence of an integrated approach, can cause serious damages estimated between 1280 and 3290 Euro/ha/year. On the other hand, the improvement pear assortment and growing technologies, withdrawn of the hazardous fungicides and release of innovative ones became reality. The situation led to necessity to establish under concrete orchard conditions the protective spectrum of the products against main pear disease and their better position inside the pear phytoprotection technologies, using specific hardware, software and decision tools, in order to increase their efficacy in the orchard and diminish the impact of treatments on the environment. This paper presents the pear culture in Romania, the main diseases affecting the culture and the possibilities to contain and control them using the actual fungicides released on the market in order to protect the pears orchards and to obtain high quality crops with less inputs. The studies carried, along two decades which reveal that among the registered fungicide tested and in use 18.0% were contact, 4.0 % translaminar and 78.0% are systemic type. In addition, 25.0% are triazols 13.0% anilino-pyrimidine and compounds, the other 62.0% being distributed among 8 other chemical groups. Some active ingredients representing 25.0% are targeting fungi biological cycle on multiple sites, 12.5% on anilino-pyrimidines and phenylpyrole chain, 12.5% on inhibition of sterol biosynthesis and the other various active ingredients 50.0% are acting against pathogens on different metabolically way.

Cuvinte cheie: păr, patogeni livadă și depozit, fungicide omologate.
Key words: pear, orchard and storage pathogens, registered_fungicides.

1. Introduction

The Romanian fruit growing, estimated at 180.000-195.000 ha is located mainly on hilly regions, inside and outside the Carpathian Mountains. After EU admission, in the last 10-15 years, the situation changed very fast. Soils diversity, climate changes and different level of the applied technology, new introduced varieties some of them vulnerable to various pest and diseases, needed to be evaluated and well protected prior to their extension in mass production. Therefore, in order to obtain high quality fruits, use of performant cultivars, of innovative cultivation techniques and phytoprotection programs are key components of production chain in the modern super intensive orchards (Amzăr, 2002, 2003; Braniște, 1999, 2011; Sumedrea et al., 2009, 2016; Teodorescu et al. 2003, 2006).

Among the most damaging apple diseases in the pear producing countries and in Romanian orchards are mainly fire blight - *Erwinia amylovora* (Amzăr and Ivaşcu 2003; Beckerman, 2009; Hartman, Hershman, 2002, Steiner and van der Zweet, 2000; Militaru et al., 2010), pear scab - *Venturia pyrina* (Amzăr and Ivaşcu, 2003; Branişte et al. 2007), brown spot - *Diplocarpon mespili, leaf spot - Mycosphaerella pyri,* (Amzăr and Ivaşcu, 2003), brown rot - *Monilinia fructigena* (Viret et Siegfried, 2011; Wenneker M., 2019) and collar rot - *Phytopthora cactorum*, (Pscheidt, J.W., 2012) etc. which can seriously affect the nursery stock and pear production and therefore must be managed under an integrated approach (Shuttleworth, 2021; Teodorescu et al. 2003;), avoiding to create resistance to active ingredients or combinations (Damicone, 2016), aiming to obtain healthy fruits according the market requirements and consumer needs. Sustainable fungicides use is a balance between diseases control and environmental protection. (Peter et al., 2021). Since the approval of the EU Directive 128/2009 that established a framework for Community action to achieve the sustainable use of pesticides, the adoption of IPM becomes compulsory in Europe (Damos et all, 2015; Valiuškaitė et al., 2017) and in Romania as well.

Aiming to make the production horticulture more environmental friendly and the products more safe for the consumers, in the last decade, 78 active ingredients and combinations were put on a 'red list', many of them being banned or withdrawn for use in horticulture and from pear production as well, making pear orchards very difficult to maintained, trained and exploited. Development of modern fruit growing to stand up to the competition pressure, requires constant efforts for the optimization of growing technologies, to reduce the agrochemical inputs used, to use them in a durable and responsible manner, in order to minimize the impact of fruit production chain on the environment, and better valorization of the pear production, deficient on the domestic fruits market.

2. Material and methods

The researches were conducted during 2009-2024, at Research Institute for Fruit Growing Pitesti Romania [44.51.30 N, 24.52.00 E; 240 m altitude], where the plantings are located on loam-clay soils, poor in nitrogen and phosphorus (nitrogen index 0.33-1.43; PAL 1.3-2.5 mg /100 g) but well supplied with potassium (up to 40 mg /100 g). The cationic exchange capacity 68.4 me /100 g, water holding capacity 50%, organic matter content less than 1.8 and the soil pH 5.6 being favorable for growing apples. However, the multi-annual climatic data (1969-2024) reveals annual rainfall plus of 121 mm, from October to February and annual rainfall deficits of 153 mm, from March to September even October with annual significant changes.

The biological material for the trials consisted in both Romanian and foreign sensitive pear cultivars, grafted on domestic pear rootstocks, and planted in experimental plots with density ranging between 675 and 1000 trees/ha, trained as palmetto or spindle-bush, with variable behavior on the main bacterial and fungal diseases which affect the pear crop.

The phytosanitary treatments were precise forecasted and carried on, based on the reserve of the pathogens which survived over winter, the pear varieties trees phenology stages, and also related to the evolution of the climatic parameters, monitored and registered with the WatchDog and Pessl automate weather stations and their software. Meteorological data were stored, processed and analyzed using the facilities of the SpecWare 9.0 (Spectrum Technologies Inc. 60544 Plainfield Illinois, USA) and iMetos 3.0 (Pessl GmbH) professional software and their diseases forecast modules.

In the experimental plots the phytosanitary treatments with fungicides were applied with STIHL 400 series.

The coverage quality was verified using Novartis sensitive paper and assessed using mobile applications, *SnapCard* developed by the University of Western Australia and the Department of Agriculture and Food and since 2024 with *DropLeaf Spraying Analysis* developed by the experts of University of Sao Paolo and National Scientific and Technological Council.

During the study period (2009-2024) more than 20 active ingredients and combinations were assessed, as regard their protective effect against fire blight, pear scab, leaf spot, brown rot and collar rot and other occasional fungi which affect the pears varieties and rootstocks. The rests of products, solution, and water from washing the spraying equipment were neutralized in installations type Pytobac, Heliosec or RemDry.

The risk of firelight attack was assessed using the Cougar scale (where '0'=no risk; '1'=low risk; '2'=medium risk and '3'=high risk), disease attack frequency and intensity were done using a modified Van der Zweet scale, where 10=healthy tree and 0=dead tree).

The damages caused in by pathogenic fungi were estimated, both as attack incidence or frequency and as damages degree.

The attack frequency (F%) was calculated using the formula:

$$\mathbf{F\% = (n/N) \times 100} \quad (1)$$

where, n = number of affected organs, and N = total number of the de observed organs.

To evaluate the attack intensity (I) the notes upon a 1-7 scale was used, where, 1=lack of the attack; 2= <3%; 3=3-10%; 4=11-25%; 5=26-50%; 6=51-75% and 7=76-100% attack.

In each trial with studied fungicides, at the end of the evaluations, the damages degree on tree and crop DD% was calculated using the formula:

$$\mathbf{DD\% = ((F\% \times I) \times 100)} \quad (2)$$

The products biological efficacy was calculated upon Abbott's formula:

$$\mathbf{E\% = ((1\text{-}T/UT) \times 100)} \quad (3)$$

where T = F% in treated variant/plot and UT=F% in untreated variants/plot.

The resulted amounts of raw data, collected from the orchard, were stored, ranged and processed using MS Excel 2010 charts and calculations facilities.

3. Results and discussions

Assessment of the Fig. 1 and 2 reveals the importance of pear crop word wide and the fact that 83% of the orchards and pear production are realized in China (83.3%). In the Europe, the second pears producer and consumer, the harvested pear area raised up at 143643 ha (FAOSTAT, 2025).

In this competition Romania holding the 9th place as regard the pear production (~46.000 t /year) and the 10th place planted surfaces (3.230 ha) (FAOSTAT, 2025). (Fig. 3 and 4).

The results obtained in the last pentade by Militaru, Maresi (Gherghina) and Hoza, (2020-2023), revealed that there are pear varieties like: 'Cu miezul roșu', 'Argessis', 'Haydeea', 'Romcor', 'Cristal', 'Paradise', 'Euras', 'Aniversare', 'Kieffer Seedling', 'Tudor',showing constant resistance/tolerance to fire blight, some others like: 'Pepenii', 'Argessis', 'Haydeea', 'Paradox', 'Isadora', 'Corina', which displayed resistance/tolerance to pear *Psylla*. Some other varieties like: 'Daciana', 'Carpica', 'Ervina', 'Romcor', 'Cristal', 'Tudor', 'Paradise', 'Republica' varieties displayed constant resistance/tolerance to pear scab.

These results suggest the possibility of their phytoprotection with fewer interventions and focused on the control of pests and other key diseases which affect the modern pear orchards. For other pear varieties, detailed phytoprotection programs must be design and design in a more specific way.

Under our country conditions, the apple assortment is well balanced with Romanian varieties (60%) and foreign varieties (31%) and vegetative rootstock (7%) required by the fruits market and consumers but with vulnerabilities related to the key pathogens attack (Fig. 5).

The multiannual assessments of varieties in collections, contest trials and untreated control variants, allow us to reveal the assortments vulnerabilities, forecast the diseases strike, to locate our trials or demo plots with fungicides on the most sensitive varieties, to display multiple work variants with fungicides However, the pear varieties assessments must be amplified, especially regarding their behavior to *Diplocarpon mespili, leaf spot - Mycosphaerella pyri,* brown rot - *Monilinia fructigena* and collar rot - *Phytopthora cactorum* (Fig. 6).

The investigations were conducted according the EPPO, national and international guidelines and regulations, to assess the fungicides capabilities under concrete microclimate conditions (see Fig. 7) using various registered active ingredients and combinations, by their better positioning inside integrated treatment programs, designed for pear crop protection, targeted varieties pathogens, active ingredients available nowadays, the best application practices concomitant with environment farmers and consumers protection. Trials data were collected, organized and stored in an intuitive database which is interrogated periodically and serve us as support and decision tool.

Among the tested and registered chemical fungicides for pear protection 12% includes inorganic and the 88% organic active ingredients obtained by chemical synthesis (Fig. 8). Taking into account their action type 50% of the products acts by contact, 6% with translaminar activity, penetrating the leaves lamina and the many others (44%) acts systemic against pathogens into the plants tissues, following many specific metabolic chains (Fig. 9).

A deep look in the Figure 10 highlight that, by chemical group, the fungicides studied in the last two decades in fruit growing of Romania and registered for pear crop protection, belongs to 10 chemicals group. The most important groups are the triazols (25.0%), followed by organic copper and anilino-pirimidines and phtalimides, ethyl phosphonates and compounds (13% each group), sulfur, inorganic copper and its compounds, (12.5% each group), quinones and their compounds, and pyrazole-4-carboxamides (6.0% each group).

As regard the metabolic way of action against the main apple pathogens (Fig.11), the fungicides studied and accepted for pear crop protection, are acting on 10 different metabolic ways. The multisite active ingredients (25.0%) are fighting against the pear pathogens from organs surfaces and had stopping power of the early or late infections. Some of the multisite active substances, the ones acting on phosphonates metabolism (7.0%), seem to trigger the defense mechanisms of the plants.

The majority of the systemic active ingredients studied (49.0%) interfere with the pathogenic fungi DMI sterols via biosynthesis inhibition. The ingredients acting on anilino-pyrimidine and phenylpyrole metabolism of the pear pathogens represents each 13.0% and 6.0%, the other active ingredients of the fungicides registered and accepted for pear crop protection acts on different metabolic ways, each representing only 6.0%.

The figure 12 was drawn using the time period from registration to the present of the 20 active ingredients and combination studied and accepted for pear crop protection, which are usable in present and near future. It can be noticed that each cluster of important active ingredients has one or more with a long period of use.

Among the copper products the longer use period had copper oxychloride, 23 years. But metiram based products were used for more than 32 years.

Among the triazols molecules, the most intensively used were difenoconazole and its combination (12 years). Pyrimetanil, from the anilino-pyrimidines branch (19 years), pretty much as cyprodynil alone (13 years), but they are very specific in targeting pear scab and leaf spots.

A particular situation is the use of copper hydroxide (24 years) and aluminum phosetyl (27 years). They control a broad control spectrum of apple pathogens and aluminum phosetyl was signaled as trigger the defense mechanisms of the plants. Both of the active ingredients are playing a major role in pear trees protection against fireblight - *Erwinia amylovora*, which explain their use for a long period of time. In the same situation (28 years of use) is the combination of actives cyprodinil+fludioxonil, which is targeting the pathogens involved in pear storage diseases attack.

It can be also noticed that, for many active ingredients, except captan, the number of applications in the orchard per growing season ranged between two and four, which many times was correlated with the recommended intervals between treatments and the pre-harvest treatment intervals indicated both in the label and in good agricultural practices. Also, to increase the active ingredients range, and systemic fungicides efficiency (especially the ones acting on DMI sterol synthesis inhibitors), many companies decides to combine innovative active ingredients (Fig.13).

The most active ingredients studied the interval between treatments were ranging between 7 and 14 days. As regard the post-harvest interval this ranged between 14-21, 28-35 and 56-60 days, according rate used and number of applications (Figure 14).

Therefore, it is logical and safer to put the products including copper, captan and metiram at the beginning and of the pear protection programs, also because of their effectiveness against early stages of the pathogens cycle.

Assessment of the figure 15 highlights the average efficacy (EAbbott-%) of the studied active ingredients in control of the main pathogens of the pear crop.

In this sense, under our conditions for the control of fire blight - *Erwinia amylovora,* the copper products average efficacy E% was ranging between 82.97-91.66 (stdev=6.1448; var=7.0375), but the average efficacy of the aluminum fosetyl based products was 92.63.

For containment of pear scab - *Venturia pyrina* products average efficacy ranged with active ingredient. The copper products efficacy E%, varied between 82.97-92.41 (stdev=6.1448; var=7.0375).

By comparison, dithiocarbamates and phtalimids products, provided an efficacy E% ranging between 84.76-86.78 (stdev=1.4284; var=1.6653).

The systemic active ingredients, acting against scab on DMI sterol biosynthesis inhibition metabolic chain, offered an efficacy E% between 91.69--96.09 (stdev=3.1113; var=3.3137).

Fungicides based on anilino-pyrimidines and guanidine metabolic chains, insured an efficacy E% between 92.30-96.45. (stdev=2.9345; var=3.1094).

Products with combined active ingredients from the groups of quinones and phtalimids, oximino-acetate and phosphonates and phenyl-acetamide provided an efficacy E% ranging between 86.78-93.90 (stdev=5.0346; var=5.5729).

For the control of *leaf spot - Mycosphaerella pyri*, the sulfur products efficacy E% was around 85.44. By comparison, dithiocarbamates and phtalimids products, provided an efficacy E% ranging between 84.30-84.50 (stdev=0.1414; var=0.1676).

The products including systemic active ingredients, active against scab on DMI sterol biosynthesis inhibition, offered an average efficacy E% ranging between 91.61-99.98 (stdev=5.6993; var=5.9585).

Systemic fungicides with active ingredients from the groups of quinones and phtalimids, oximino-acetate and phosphonates and phenyl-acetamide provided an efficacy E% ranging between 84.30-94.60 (stdev=7.2832; var=8.1422).

In order to restraint the brown rot attack - *Monilinia fructigena* and some other storage diseases pathogen attack on pears, contact and systemic fungicides were studied.

The copper products average efficacy E% was ranging between 85.08--90.70 (stdev=3.1750; var=3.5777). Comparatively, fungicides with the molecules included in the phtalimids group offered an average efficacy E% of 90.03%.

Some products studied, including systemic active ingredients, acting against scab on DMI sterol biosynthesis inhibition, offered an average efficacy E% between 91.67--97.56 (stdev=4.1649; var=4.4019).

Fungicides based on systemic active ingredients involved anilino-pyrimidines and guanidine metabolic chains insured an efficacy E% ranging between 95.71-94.60- (stdev=0.7849; var=0.9249).

Acting on anilino-pyrimidines & phenylpyrole metabolic way of fungi, the protection against other storage diseases and other pathogens an efficacy of 98.50% was achieved.

After the study period we were able to elaborate a compatibility chart between the active ingredients and combination assessed during the study period.

After the study period we were able to elaborate a compatibility chart between the active ingredients and combination assessed in order to be used in pear crop phytoprotection.

The interdiction and withdrawn of many chemical active ingredients, designed to control many pathogens, lead also to a strong need for the near future to amplify the researches control them also using biological agents such as products based on various vegetal extracts or beneficial microorganisms such as *Aureobasidium pululans*, *Bacillus amyloliquefaciens*, *Bacillus mycoides*, *Pantotea agglomerans*, *Raynutria sachalinenisi* strains etc., as well as extension into the culture of resistant or tolerant pear varieties, aiming to maintain healthier orchards for the farmer benefit and healthier fruits and derivate as consumers, require every day.

4. Conclusions

The following conclusions can be drawn from the study:

- There is a strong need for the extension into the culture of the resistant or tolerant pear varieties ('Argessis', 'Daciana', 'Carpica', 'Monica' 'Haydeea', 'Cristal', 'Romcor', 'Paradox', 'Paradise', 'Euras', 'Ervina', 'Corina', 'Tudor', 'Isadora', 'Pandora', 'Aniversare', 'Republica', 'Kieffer Seedling', 'Cu miezul roșu', 'Pepenii'), to establish and maintain healthier pear orchards, for the farmer benefit and healthier fruits and derivate as consumers requires every day.
- It is useful to control primary infections using systemic or combined with contact actives, sometimes till mid of June, to prevent the new infections occurrence. Also, adequate orchard architecture, inspections and hygiene, can lead to decrease of infections, especially with fireblight, and drop of the fungicides need, especially triazols.
- Although many application rates were tested, polyvalent fungicides acting well against more than two important pathogens, at the minimum effective doses, were preferred and accepted in protection programs, in order to provide pear crop management, at reasonable cost of the treatments and to minimize the impact on the environment and for the better acceptance of fruits and derivates on the market as well.
- In order to increase the fungicides efficacy in pear crop protection, especially for the systemic ones, it will be useful and opportune additional researches, on active ingredients complementarity, water quality, monitoring spray equipment calibration, and improvement of applications quality, use of adjuvants and anti-drift nozzles, especially when the treatments are carried during the wet periods, in windy areas, near water corps or human habitat.
- The interdiction and withdrawn of many active ingredients, designed to control main pear pathogens, lead also to a strong need to amplify the researches control them for the near future, also using biological agents such as: various vegetal extracts or beneficial microorganisms.
- Because many valuable pear varieties are vulnerable on major pathogens, it seems logical to aim at fungicide treatments better positioning based on a warning system, to use smart newer molecules inside the integrate protection programs, to alternate the most used active ingredients during the growing season, or even to alternate the protection programs designed for pear orchards from an year to other.

Aknowledgements

The authors acknowledge the support of the Research Institute for Fruit Growing every day support and for funding received from the Romanian Ministry of Agriculture and Rural Development for the Project ADER 25.2.1, within the framework of which this research was conducted.

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Fruit Growing Research, Vol. XLI, 2025
https://publications.icdp.ro/index.php
DOI 10.33045/fgr.v41.2025.16

Tables and Figures

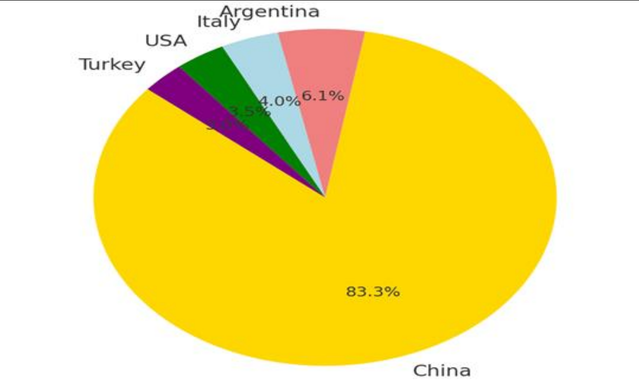

Fig. 1 World pear production distribution (Global Pear Industry, 2025)

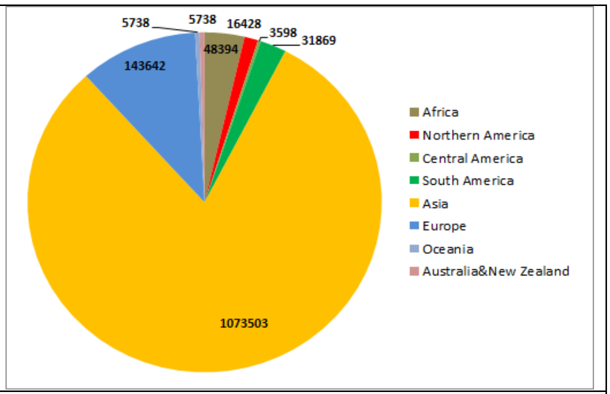

Fig. 2 World pear harvested area distribution (FAOSTAT, 2025)

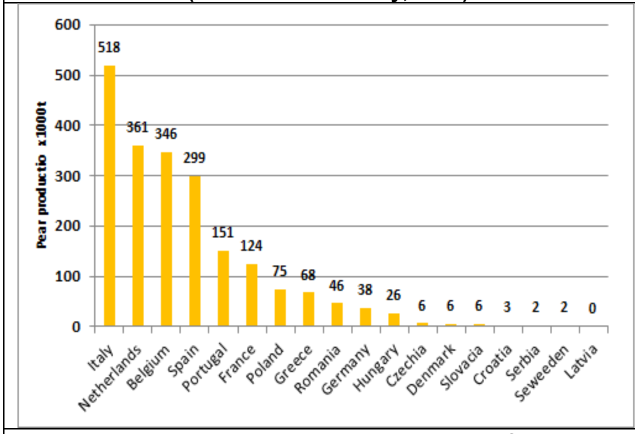

Fig. 3 Pear production [.000 t] in Europe of 2025 (FAOSTAT, 2025)

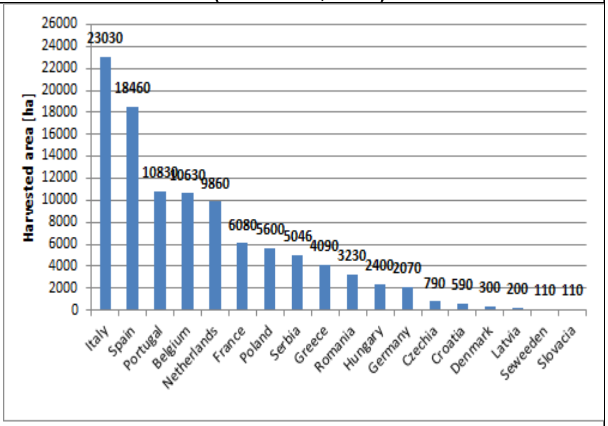

Fig. 4 Pear harvested area [ha] in Europe of 2025 (FAOSTAT, 2025)

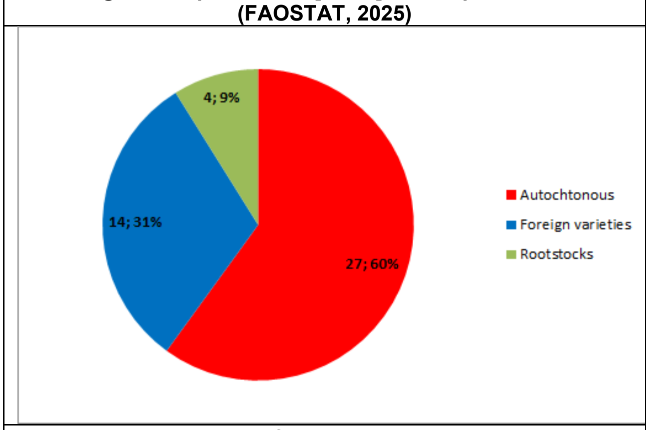

Fig. 5 Balance of the assortment extended into the pear culture in Romania

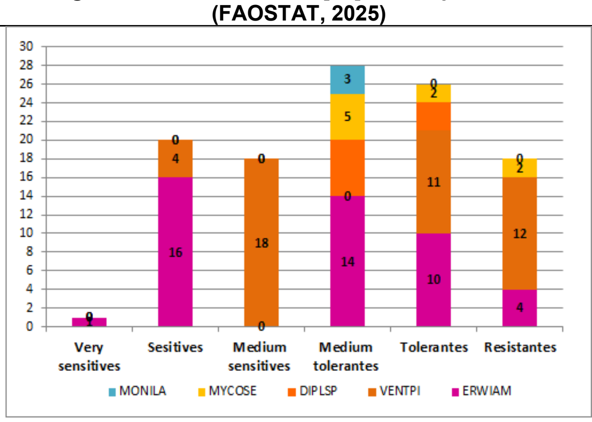

Fig. 6 Pear assortment extended into the culture in Romania and its degree of vulnerability on major diseases

DOI 10.33045/fgr.v41.2025.16

Table 1. Behavior of the Romanian pear assortment to some specific pathogens

N	Variety/Clone	ERWIAM	VENTPI	DIPLSP	MYCOSE	MONILA
1	Aniversarea	M	M	na	na	na
2	Argessis	S	M	na	na	na
3	Aromată de Bistrița	S	S	na	na	na
4	Carpica	T	T	M	M	na
5	Corina	T	R	na	na	na
6	Daciana	M	M	na	na	na
7	Doina	VS	S	na	na	na
8	Erwina	T	R	na	na	na
9	Euras	T	R	na	na	na
10	Getica	T	M	na	na	na
11	Haydeea	T	M	T	T	na
12	Ina Estival	T	M	na	na	na
13	Jubileu 50	S	S	na	na	na
14	Milenium	M	T	na	na	na
15	Monica	T	R	na	na	na
16	Napoca	M	T	na	na	na
17	Orizont	R	T	na	na	na
18	Paradis	R	T	na	na	na
19	Paradox	R	T	na	na	na
20	Paramis	R	T	na	na	na
21	Păstrăvioare	S	T	na	na	na
22	Republica	M	R	M	M	M
23	Roșioară de Cluj	S	T	NA	na	na
24	Timpurii de Dâmbovița	S	T	M	M	M
25	Triumf	S	R	T	R	na
26	Trivale	S	T	T	na	na
27	Tudor	T	R	na	na	na
28	Untoasă de Geoagiu	M	S	na	na	na
29	Alămâi*	M	M	na	na	na
30	Harbuzești*	M	M	na	na	na
31	Pepenii*	M	M	na	na	na
32	Cu miezul roșu*	T	T	na	na	na
33	Abate Fettel	M	M	na	na	na
34	Buttira Precoce Morettini	M	M	na	na	na
35	Beurré Bosc	M	M	na	na	na
36	Beurré Hardy	M	M	na	na	na
37	Conference	S	M	na	na	na
38	Curé	S	M	na	na	na
39	Comptesse de Paris	S	R	na	na	na
40	Kieffer Seedling	R	R	na	na	na
41	Jeanne d' Arc	S	M	na	na	na
42	Highland	S	M	na	na	na
43	Max Red Bartlett	S	M	na	na	na
44	Passe Crassane	S	R	na	na	na
45	Williams	S	R	na	na	na

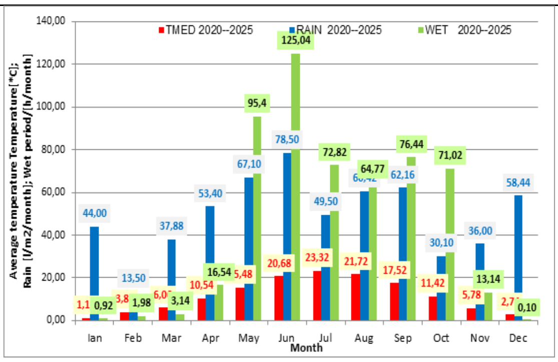

Fig. 7. Microclimate for the trials site RIFG Pitesti-Romania, Lat. N 44,513; Long. E 24,52; Alt 287m a.s.l

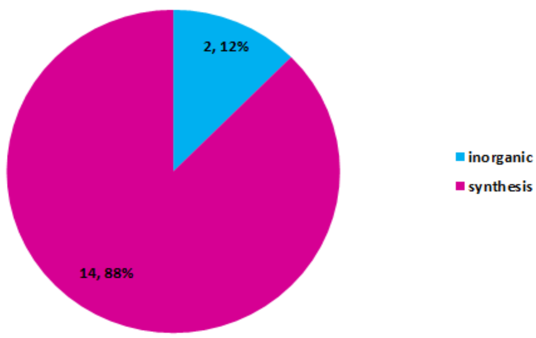

Fig 8. Registered fungicides in Romania for pear crop protection by production way

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https://publications.icdp.ro/index.php
DOI 10.33045/fgr.v41.2025.16

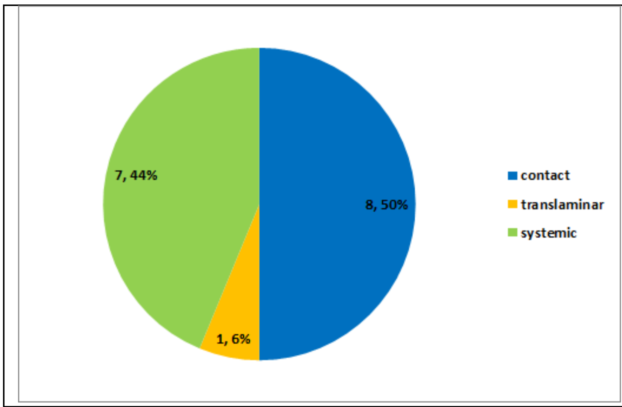

Fig. 9. Registered fungicides in Romania for pear crop protection by action type

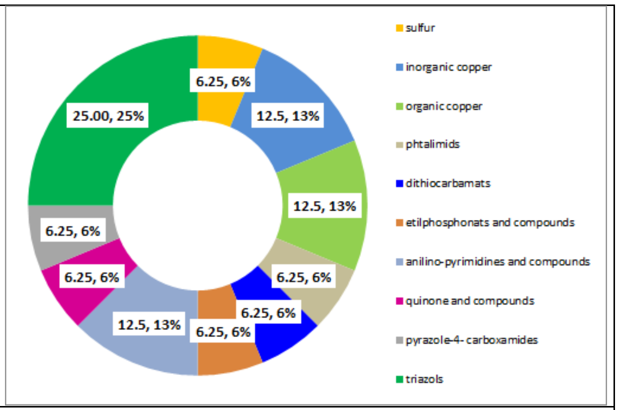

Fig. 10. Registered fungicides in Romania for pear crop protection by chemical group

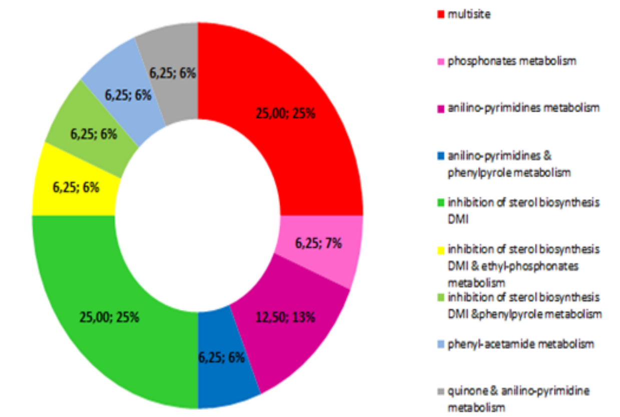

Fig. 11. Registered fungicides in Romania for pear crop protection by methabolic way of action

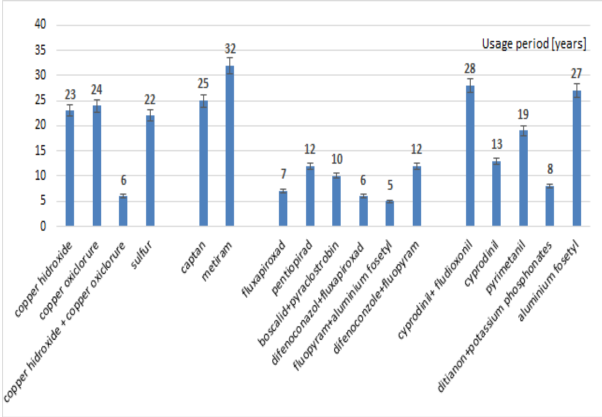

Fig. 12. Period of use for the registered fungicides for pear crop protection in Romania

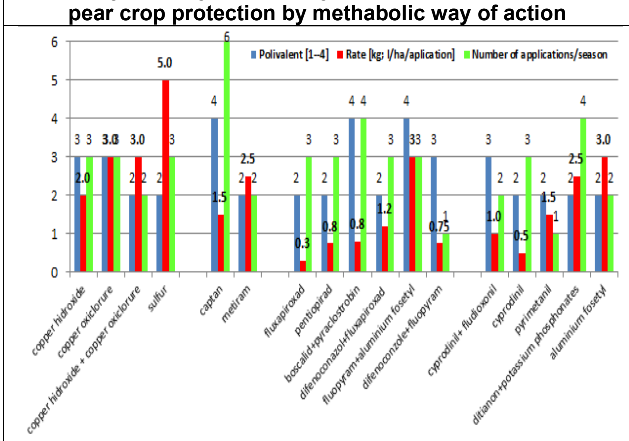

Fig. 13. Registered fungicides in Romania for pear crop protection by rate and number of applications

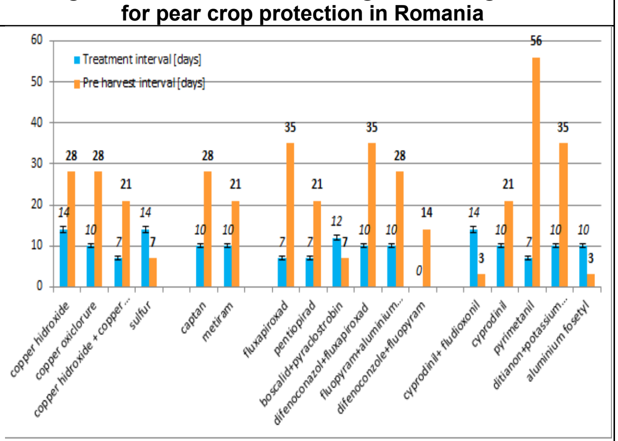

Fig. 14. Registered fungicides in Romania for pear crop protection by treatment and post-harvest intervals

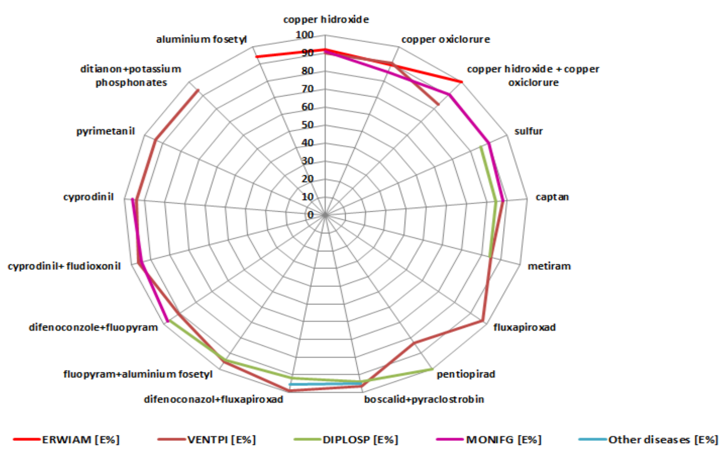

Fig. 15. Fungicides registered and used in Romania for pear crop protection and their overall efficacy

DOI 10.33045/fgr.v41.2025.16

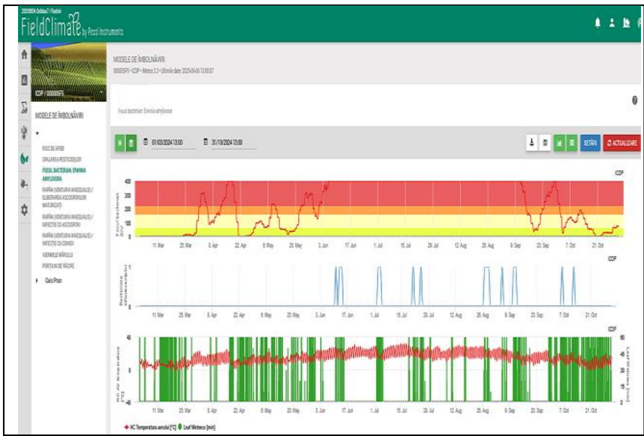

Fig. 16. Monitoring of the fireblight attack risk, 2024

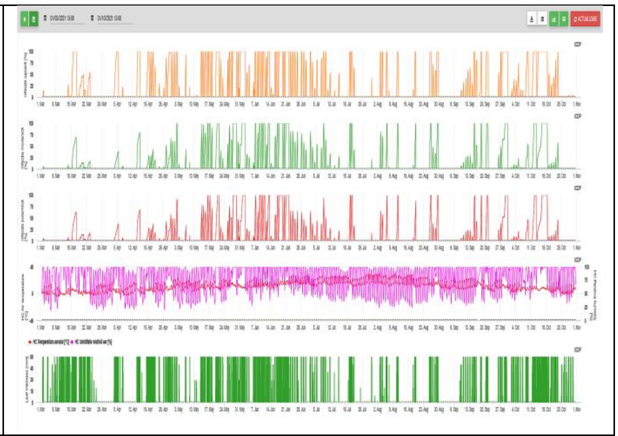

Fig. 17. Monitoring of the scab attack risk, 2024

Fig. 18. Application of experimental variants with fungicides

Fig. 19. Effluents management, 2020-2024

Table 2. Compatibility chart of the fungicides tested in order to protect the pear orchards

Active ingredient / Combinations	copper hidroxide	copper oxiclorure	copper hidroxide + copper oxiclorure	sulfur	captan	metiram	difenoconazole	fluxapiroxad	pentiopirad	cyprodinil+ fludioxonil	cyprodinil	pyrimetanil	boscalid+pyraclostrobin	difenoconazol+fluxapiroxad	fluopyram+aluminium fosetyl	difenoconzole+fluopyram	dithianon+potassium phosphonates	aluminium fosetyl
copper hidroxide	x	1	1	2	0	0	2	0	2	0	0	0	0	0	0	0	0	3
copper oxiclorure	1	x	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
copper hidroxide + copper oxiclorure	1	1	x	3	0	0	2	0	0	0	0	0	0	0	0	0	0	3
sulfur	2	0	2	x	3	0	3	0	2	0	1	0	0	0	0	0	1	0
captan	0	0	0	3	x	0	1	1	1	0	1	1	1	0	0	0	1	0
metiram	0	0	0	0	0	x	0	0	0	1	0	0	0	0	0	0	0	0
difenoconazole	2	0	2	3	1	0	x	0	0	1	1	0	1	0	0	2	1	3
fluxapiroxad	0	0	0	0	1	0	0	x	0	0	0	0	1	0	0	0	1	0
pentiopirad	2	0	0	2	1	0	1	0	x	0	0	0	1	0	0	0	1	0
cyprodinil+ fludioxonil	0	0	0	0	0	0	1	0	0	x	1	0	0	0	0	0	1	0
cyprodinil	0	0	0	1	1	0	1	0	0	1	x	0	0	0	0	0	1	0
pyrimetanil	0	0	0	0	1	0	0	0	0	0	0	x	0	0	0	0	0	0
boscalid+pyraclostrobin	0	0	0	0	1	0	1	1	1	0	0	0	x	0	0	0	0	0
difenoconazol+fluxapiroxad	0	0	0	0	0	0	0	0	0	0	0	0	0	x	0	0	0	0
fluopyram+aluminium fosetyl	0	0	0	0	0	0	0	0	0	0	0	0	0	0	x	0	0	0
difenoconzole+fluopyram	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	x	0	0
dithianon+potassium phosphonates	0	0	0	1	1	0	1	1	1	0	1	0	0	0	0	0	x	0
aluminium fosetyl	3	0	3	0	0	0	3	0	0	0	0	0	0	0	0	0	0	x