THE INFLUENCE OF THE APPLICATION OF ECO-SCHEMES REGARDING PERMANENT CROPS IN CHERRY PLANTATIONS ON BIODIVERSITY AND ENVIRONMENTAL IMPACT

INFLUENȚA APLICĂRII ECOSCHEMELOR PRIVIND CULTURILE PERMANENTE ÎN PLANTAȚIILE DE CIREȘ ASUPRA BIODIVERSITĂȚII ȘI IMPACTULUI ASUPRA MEDIULUI

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Abstract.
Observations were carried out during 2024–2025 in the experimental cherry lot of Research Station for Fruit Growing Iasi, located in Miroslava, with the objective of evaluating the impact of eco-schemes and technological variants in cherry plantations on biodiversity and reduction of external inputs. Four experimental variants (mechanical feeler, herbicide, repellent plants, biodegradable mulch) were compared in terms of the degree of attack by pathogens and pests. The results show that the variant with repellent plants had the best efficiency in reducing the pressure of pathogen and pest attack, a viable ecological alternative for integrated management of fruit plantations.
Key words: eco-schemes, cherry, repellent plants, biodiversity, biodegradable

Rezumat.
Observațiile au fost efectuate în perioada 2024–2025 în lotul experimental de cireș de pe teritoriul Stațiunii de Cercetare-Dezvoltare pentru Pomicultură Iași, localizată în Miroslava, având ca obiectiv evaluarea impactului ecoschemelor și a variantelor tehnologice aplicate în plantațiile de cireș asupra biodiversității și reducerii inputurilor externe. Patru variante experimentale (palpator mecanic, erbicidare, plante repelente, mulcire biodegradabilă) au fost comparate în ceea ce privește gradul de atac al agenților patogeni și al dăunătorilor. Rezultatele arată că varianta cu plante repelente (Allium sativum, Tagetes spp., Lavandula officinalis, Ocimum basilicum, Satureja hortensis) a avut cea mai bună eficiență în reducerea presiunii atacului agenților patogeni și a dăunătorilor, constituind o alternativă ecologică viabilă pentru managementul integrat al plantațiilor pomicole.
Cuvinte-cheie: ecoscheme, cireș, plante repelente, biodiversitate, mulcire biodegradabilă.

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INTRODUCTION

Creating a sustainable fruit ecosystem is a priority in the context of modern agriculture, where environmental pressure and climate change require the adoption of nature-friendly technologies [Altieri and Nicholls, 2017]. In recent years, traditional fruit systems have been criticized for their high resource consumption and intensive use of plant protection products, which has led to the need to integrate agroecological principles into orchard management [Wezel *et al*., 2020].

The present research aims to evaluate and introduce innovative agroecological practices in fruit plantations, such as the use of floral belts, repellent plants and conservative soil maintenance technologies, with the aim of increasing biodiversity and reducing dependence on external inputs [Simon *et al*., 2021; Garratt *et al*., 2019]. These practices contribute to maintaining ecological balance, increasing populations of pollinators and beneficial entomofauna, as well as improving soil health [Bàrberi *et al*., 2018].

The research objectives aimed to analyze natural resources and biodiversity of useful flora and fauna, assess the impact of soil maintenance works on ecosystem services, and disseminate the results among farmers and specialists in the field [Kremer and Peterson, 2022]. Thus, the study contributes to the development of an integrated vision sustainable fruit farming, adapted to current climate challenges.

MATERIAL AND METHOD

The biological material on which the studies related to the achievement of the objectives were undertaken is located in the cherry demonstration lot at SCDP Iaşi with a total area of 0.63 ha; the trees are in the 5th year after planting, are grafted on mahaleb, planted at a distance of 6 x 5 m and managed in the form of an improved pot, without a support system. As part of the experience in 2025, there were four experimental variants of soil maintenance.

In order to limit excessive mechanization, other types of tree row maintenance were practiced to the detriment of the black field, this type of maintenance strongly accentuating erosion processes. On the tree row, the soil is kept clean with the help of a feeler plow, and between the tree rows the soil is maintained as a grassy parterre.

As part of the experience for the establishment of the experimental variants, the following factors were used (Table 1) by implementing four experimental variants:

Table 1

Experimental variants

Species	Rootstock	Variants	Repetition
Cherry	mahaleb	**V1** – Trap plants used between trees	4 repetitions
		V2 – Use of herbicide on the tree row	4 repetitions
		V3 – Repellent plants	4 repetitions
		V4 – Mulching with biodegradable material	4 repetitions

In variant 1, the soil between the trees was maintained using a feeler disc, at regular intervals.

Variant 2 of the experiment was maintained using the herbicide, applied with a backpack spray pump.

In variant 3, repellent plants were planted or sown to limit the attack of pathogens and pests but also to maintain the soil between the trees cultivated with these sanitary-accompanying species.

Variant no. 4 of the experiment was maintained using biodegradable mulching foil, made of polyethylene or perforated agrotextile, which is distributed only in the direction of the row.

Each variant had four repetitions. Monitoring was carried out through phenological and phytosanitary observations, assessment of the degree of attack (GA%) of pathogens and pests, as well as analysis of climatic and edaphic conditions during the period September 2024 - August 2025.

As part of the experience, an integrated pathogen and pest control program was applied to limit the attack caused by them and maintain cultural hygiene.

Phytosanitary treatments were limited, namely 4 phytosanitary treatments (Table 2), in correlation with tree phenology (BBCH) and based on catches recorded on phytosanitary traps in order to carry out as few phytosanitary treatments as possible, in order to protect useful entomofauna.

Table 2

Cherry treatment program – SCDP Iași 2025

<table>
<tr><th>No.</th><th>Phenophase</th><th>Product</th><th>Dose ha/1000 L</th></tr>
<tr><td rowspan="3">T1 – BBCH 07-10</td><td rowspan="3">Bud burst – White bud stage</td><td>Bouille Bordelaise WDG</td><td>5 kg</td></tr>
<tr><td>Decis Expert</td><td>0.1 L</td></tr>
<tr><td>Polyactiv B</td><td>2 L</td></tr>
<tr><td rowspan="3">T2 – BBCH 65</td><td rowspan="3">Petal fall</td><td>Signum</td><td>0.5 kg</td></tr>
<tr><td>Mospilan 20 SG</td><td>0.45 kg</td></tr>
<tr><td>Polyactiv B</td><td>2 L</td></tr>
<tr><td rowspan="3">T3 – BBCH 74-80</td><td rowspan="3">Fruit coloring</td><td>Folicur Solo</td><td>0.75 L</td></tr>
<tr><td>Energevo</td><td>3 kg</td></tr>
<tr><td>Karate Zeon</td><td>0.25 L</td></tr>
<tr><td rowspan="2">T4 – BBCH 84</td><td rowspan="2">7 days before harvest</td><td>Signum</td><td>0.5 kg</td></tr>
<tr><td>Karate Zeon</td><td>0.2 L</td></tr>
</table>

RESULTS AND DISCUSSIONS

Within the experiment, 3 determinations were made on the attack of pathogens (*Stigmina carpophilla* m.b. ellis., *Coccomyces hiemalis* HIGG) and pests (*Rhagoletis cerasi* L., *Sciaphobus squalidus*, leaf miners and *Myzus cerasi*).

The study followed the influence of four technological variants on the degree of attack (GA%) of pathogens on cherry, evaluated in three key phenological moments: May 20 (Figure 1), June 18 and August 4. The data highlight significant variations in the intensity of the attack depending on the treatment applied and the evaluation period (Figure 2).

Fig.1 Cherry orchard in full bloom

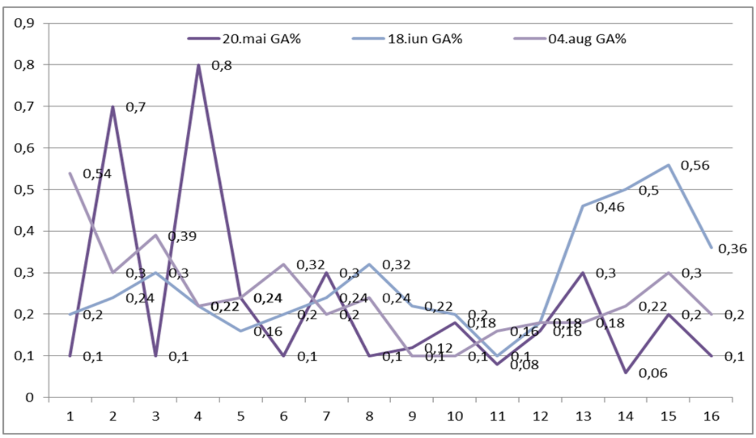

Fig 2. The degree of attack of pathogens encountered in the cherry orchard

V1 – Feeler used between trees

This variant presented the highest GA% values, with a peak of 0.8 %, recorded on May 20. Although a slight reduction in values is observed in June (0.22–0.3%), they increase again in August, reaching values up to 0.54%. The results indicate a low efficiency of this treatment in limiting the pathogenic pressure, possibly due to the fact that the use of the feeler does not sufficiently reduce the source of inoculum or does not directly influence the factors favoring the infection.

V2 – Use of herbicides in the tree row

Variant V2 generated average GA% values, relatively constant throughout the three evaluations. The values were in the range of 0.1–0.32%, suggesting a moderate efficiency of herbicides in reducing the incidence of diseases. It can be assumed that the elimination of adventitious vegetation in the row contributes partially to the reduction of excessive humidity and the infectious potential in the basal area of the trees.

V3 – Repellent plants (*Allium sativum spp., Tagetes spp., Lavandula officinalis, Ocimum basilicum, Satureja hortensis L.)*

This variant was distinguished by the lowest and most constant GA% values throughout the entire observation period, with values ranging between 0.08% and 0.22%. The high efficiency can be attributed to the action of phytoncides and volatile compounds emitted by repellent plants, which inhibit the development of pathogens or reduce the attractiveness of the environment for disease vectors.

V4 – Mulching with biodegradable material

Mulching generated oscillating results. Although in May the GA% values were reduced (0.06–0.3%), in June the highest values of the entire experiment were recorded (up to 0.56%). Subsequently, in August, the degree of attack decreased, but remained relatively high. These data suggest that mulching, although beneficial for water conservation and weed suppression, can create a humid and warm microclimate favorable to pathogen proliferation, especially under climatic conditions favorable to infection.

The comparative evaluation of the four treatment variants applied in the cherry orchard allowed highlighting their impact on the dynamics of pest attack during the vegetation period. The attack degree values (GA%), expressed as a function of the frequency (F%) and intensity (I%) of the attack, were recorded in three phenological stages: May 22, June 20 and August 1.

The data analysis indicates that each technological variant influenced the level of pest attack differently (Figure 3).

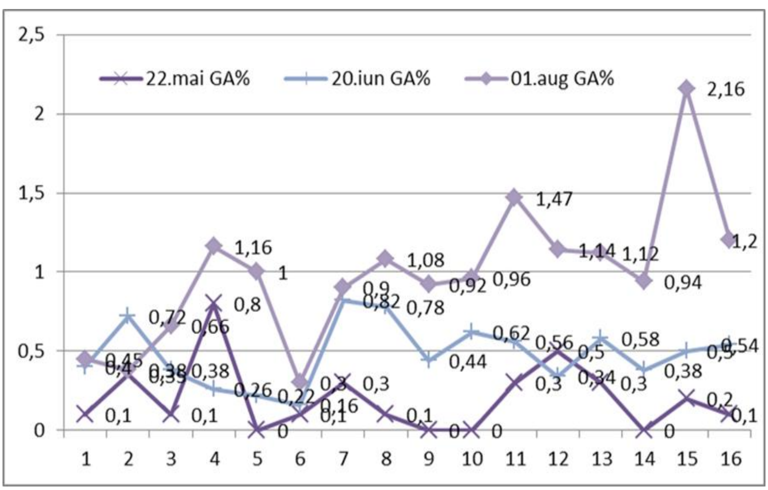

Fig 3. Degree of attack by cherry pests

V1 – Feeler used between trees (Figure 4)

This variant showed an upward evolution of the attack level, from low values in May (GA% = 0.1–0.8%) to high values in August (up to GA% = 1.16%). Although mechanical soil maintenance contributes to weed control, it does not have a direct effect on reducing pest populations, and the disturbance of the natural habitat can even stimulate the activity of some harmful species, in the absence of complementary measures.

Fig 4. Aspects from the experimental field

V2 – Use of herbicides on the tree row

Herbicide had a moderate initial efficiency (GA% ≤ 0.3% in May), but in the second half of the season a significant increase in attack was noted, culminating in values of over 1% in August. Possibly, the complete elimination of spontaneous vegetation contributed to the imbalance of the beneficial fauna, favoring the development of pests in the absence of natural predators or alternative hosts.

V3 – Repellent plants (*Allium sativum*, *Tagetes* spp, *Lavandula officinalis*, *Satureja hortensis*, *Ocimum basilicum*)

This variant recorded the lowest GA% values in May, some even zero, which indicates the initial efficiency of the volatile compounds emitted by the repellent plants in deterring pests. However, in the following months, the efficiency of these plants gradually decreased, with a significant attack being recorded in August (GA% of up to 1.47%). This can be attributed to the decrease in the concentration of active substances in plants under heat stress conditions or the development of pest resistance to these natural stimuli.

V4 – Mulching with biodegradable material; Although initially this method had moderate results (GA% ≤ 0.3% in May), during the summer an increase in attack was observed, reaching the highest values of all variants in August (with a maximum of 2.16%).

The mulching material probably contributed to the creation of a microclimate favorable to the development of some pests (high humidity, constant temperature, physical protection). Also, in the absence of additional interventions, this system allowed the uncontrolled multiplication of species developing on the ground or in the mulch layer.

CONCLUSIONS

Among the tested variants, V3 (repellent plants) demonstrated the best efficiency in reducing the degree of attack, constituting a viable ecological alternative in the integrated protection of cherry. On the other hand, V1 (Feeler used between trees) proved ineffective, requiring the completion with other phytosanitary measures. Variants V2 and V4 had variable efficiency, requiring optimization of the application regime or combination with other agrophytotechnical practices.

The interpretation of the data shows that, although the ecological treatment variants (repellent plants and mulching) may have initial benefits, their efficiency may decrease over time if they are not supported by complementary measures. Also, conventional methods (herbicides, mechanical works) may lead to ecological imbalances, favoring the development of harmful entomofauna in the absence of biological or integrated protection.

The climatic conditions during this period were favorable for the evolution of the attack of pathogens (*Stigmina carpophilla* m.b. ellis., *Coccomyces hiemalis* HIGG.) as well as the pests *Rhagoletis cerasi* L., *Sciaphobus squalidus*, leaf miners and *Myzus cerasi*.

In combating pathogens (*Stigmina carpophilla* m.b. ellis., *Coccomyces hiemalis* HIGG.)) the best results were obtained with the help of fungicides *Signum* and *Folicur Solo.*

Also, the insecticides *Decis 25, Exirel, Karate zeon* recorded high efficacy in combating pests.

As a general conclusion regarding the application of phytosanitary products accompanied by repellent plants - we can say that they have an important role and can be recommended in the cultivation technologies of the cherry species and encouraging farmers to also focus on products with reduced toxicity for humans and the environment.

The introduction of repellent plants into the crop gives us confidence that we can limit the number of treatments with their help, even if phytosanitary treatments were also used in the experience, a limitation of the attack by pests in the analyzed crop is observed, also the area in which the plantation is located greatly influences the evolution of pathogens and pests, these aspects must be taken into account when we want to establish a plantation regardless of the crop system.

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REFERENCES

1. **Altieri M.A., Nicholls C.I., 2017 –** *Agroecology: a transdisciplinary, participatory and action-oriented approach*. CRC Press.
2. **Bàrberi P., Moonen A.-C., Mazzoncini M., 2018 –** *Agroecological approaches to promote soil and biodiversity conservation in fruit orchards*. Agriculture, Ecosystems & Environment, 265, 12–23.
3. **Garratt M.P.D., Senapathi D., Coston D.J., Mortimer S.R., Potts S.G., 2019 –** *The benefits of flower-rich habitats for pollinators and natural enemies in agricultural landscapes*. Journal of Applied Ecology, 56(2), 233–243.
4. **Kremer R.J., Peterson H.M., 2022 –** *Sustainable soil management in perennial cropping systems*. Frontiers in Sustainable Food Systems, 6, 841563.
5. **Simon S., Lescourret F., Plénet D., Capowiez Y., 2021 –** *Designing agroecological orchards for biodiversity and ecosystem services*. Agronomy for Sustainable Development, 41(3), 45.
6. **Wezel A., Herren B. G., Kerr R.B., Barrios E., Gonçalves A.L.R., Sinclair F., 2020 –** *Agroecological principles and elements and their implications for transitioning to sustainable food systems. A Review*, Agroecology and Sustainable Food Systems, 44(5), 561–578.