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# ECONOMIC IMPACT OF BIRDS' ATTACKS ON SUNFLOWER CROPS - CASE STUDY

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***Abstract***

*The economic impact of birds on sunflower crops is less studied in Romania and worldwide. In the present study, three sunflower crops established near Timisoara were analysed. The aim of the study was to highlight the economic losses produced by birds during the emergence of seedlings or immediately after sowing as well as before harvesting. The hybrids cultivated were NK Neoma and SY Futura AR. Yield damage was estimated both after emerging and before harvest. Bird flocks were visually assessed by direct field observations during feeding. The birds species identified were Columba livia livia and Corvus frugilegus. Economic losses were calculated considering all technological elements. Damage was 100% in the plot A521 (2.5 ha) and 90% in the plot A519 (6.5 ha). The plot A136 (14.84 ha) was not attacked by birds. The expenses were 3,826.7 lei/ha in 2024. The yields were 0 kg (plot A521), 277 kg (plot A519) and 2670 kg (plot A136). Profit was achieved on plot A136 in the amount of 1,342.3 lei. The selling price for sunflower seeds was 1.8 lei/kg in 2024.*

***Key words*****:** *sunflower, Columba livia livia, Corvus frugilegus, economic loses, birds*

## INTRODUCTION

In recent years, birds have become a real problem for many agricultural areas in Romania. The greatest damage is most often recorded in agricultural fields placed near urban and rural settlements, roads, forests, woodlands, hedgerows, and parks [11]. In these areas, there are shrubs and trees where birds can nest peacefully and food is accessible. Among cultivated plants, the sunflower crop is the most susceptible to attack, preferred by sparrows, blackbirds, pigeons and different species of crows [17]. The preference of birds for sunflower crop instead of other cultivated plants (maize, wheat, barley, etc.) was also reported by Klosterman *et al.* [12].

Studies on bird attacks on sunflower crops are few because estimating damage is often difficult, especially if the birds are not seen at feeding time. Most refer to bird attacks after flowering and during seed ripening, and very few to the damage during germination and sprouting of sunflower plants [13]. The same authors indicate that, worldwide, the species of birds that attack sunflower crop belong to the families *Corvidae*, *Columbidae*, *Icteridae*, *Psittacidae*, *Passeridae* and *Cacatuidae*.

In Europe, damage is caused to sunflower crop by *Passeridae* (*Passer montanus*, *Passer hispaniolensis*), *Columbidae* (*Streptopelia decaocto*, *Streptopelia turtur*) and *Corvidae*. Mentions of damage by birds to sunflower crop during sunflower emergence occur in France, Italy and Switzerland [11]. In France, attacks by birds of the families *Corvidae* and *Columbidae* during sunflower emergence have been reported. Sausse *et al.* [18] show

that in recent years reported damage is increasing during crop establishment.

In Romania, Arion [2] mentions several species of birds harmful to agriculture: *Corvus cornix* L. (western grey crow), *Corvus cornix sardomus* Kleinem (eastern grey crow), *Corvus frugilegus* L. (the rook), *Pica pica pica* L. (corncrake), *Passer montanus* L. (field sparrow) and *Passer domesticus* L. (house sparrow). The same species are also mentioned by Rădulescu & Săvescu [15]. Perju [14] mentions *Columba livia livia* L. (domestic pigeon) and *Streptopelia turtur* L. (house pigeon).

Among the *Columbidae* species, the most common in agricultural areas in Romania are *Columba livia livia* and *Columba palumbus* and among the *Corvidae*, *Corvus frugilegus* [7, 8]. These birds cause significant damage to sunflower crop and maize during seedling emergence and before harvest in the southern, southeastern and western areas of Romania. Georgescu *et al.* state that between 2021 and 2022, *the rook* massively attacked maize and sunflower crops, causing significant damage (unpublished data).

While in Europe bird attacks are less studied, on the American continent, much research is being done on damage assessment methods and how to remove them from agricultural areas. Ernst *et al.*[6] assessed economic damage to sunflower crop by birds in a study in North Dakota. It shows that yield losses ranged from 5 - 15% (considered significant). In financial terms, the damage was $28.6 million [6].

In Argentina, losses between 5% and 20% in yield are reported when sunflower plants are attacked at maturity. The incidence of attacked plants is 21 - 35% [3; 20].

Farmers in Romania rarely report bird damage during sunflower plant emerging. Damage is most often reported during ripening when birds are feeding heavily. Bird control is often lost by farmers who cannot control them with any known method. In the past, neonicotinoid insecticides used to treat seeds provided brief protection during emerging. Now, these substances are banned, and damage is increasing. Farmers are sometimes forced to abandon sunflower cultivation because of hungry birds [1].

This study was based on an exceptional situation registered in 2024, when two sunflower plots established near Timisoara were compromised by birds immediately after sowing. This situation was analysed in comparison to a sunflower plot that was not attacked by birds and was established at a greater distance from the inhabited area. Pre-harvest damage was also estimated. The aim of the study was to highlight the damage in production, the costs of sowing and subsequent reseeding and other technological links. The conclusion of the study was that the economic impact of bird attacks during the planting period is major.

## MATERIALS AND METHODS

In this study, three plots cultivated with sunflower crop in the spring of 2024 in the perimeter of the Didactic Station of the University of Life Sciences "King Mihai I" from Timisoara were observed. Two fields were established near the university at a distance of about 150 m from each other and the third one about 20 km from Timișoara (Cioreni farm).

The GPS coordinates of the three fields were:

- plot A521 - BF 741: latitude 45.783857, longitude 21.210318;
- plot A519 - BF 340: latitude 45.786061, longitude 21.212773;
- plot A136 - BF 639: latitude 45.815479, longitude 21.144063.

The altitude in the analysed areas is 87 m.

The area of the three sunflower plots differed as follows:

- plot A521 - BF 741 – 2.5 ha (Timișoara);
- plot A519 - BF 340 – 6.5 ha (Timișoara);
- plot A136 - BF 639 – 14.84 ha (Cioreni).

The hybrids used for sowing were: SY Futura AR and NK Neoma. The sowing date differed for each plot, as were the dates on which reseeding was done.

Dates on which sowing was done, number of germinable seeds/ha and hybrid used:

- plot A521 - seeded at 11.04.2024, hybrid SY Futura AR, 67,000 germinable seeds/ha; reseeded I at 25.04.2024, hybrid NK Neoma,

67,000 germinable seeds/ha; reseeded II at 10.05.2024, hybrid NK Neoma, 67,000 germinable seeds/ha - Timișoara (Photo 1).

- plot A519 - seeded at 20.04.2024, hybrid Futura, 67,000 germinable seeds/ha; reseeded I at 29.04.2024; hybrid NK Neoma, 67,000 germinable seeds/ha; reseeded II at 25.05.2024, hybrid NK Neoma, 67,000 la 25.05.2024/ha -Timișoara.
- plot 136 - seeded at 13.04.2024, hybrid SY Futura AR, 67,000 germinable seeds/ha - Cioreni.

Photo 1. Plot seeding, A 521, hybrid SY Futura AR, Timișoara
Source: Original photo by Cotuna Otilia, 2024.

The size of flocks was determined by visual observations directly in the field when birds were present and feeding. It is quite difficult to count birds if you don't have a drone as birds are always in flight. Birds could not be accurately quantified but numbers were estimated to be around 400 - 500 *Columbidae* (*Columba livia livia*) and *Corvidae* (*Corvus frugilegus*).

Damages during emerging of seedlings were assessed according to the following scale: 0 - undamaged seedlings; 1 - seedlings with two cotyledons but damaged; 2 - seedlings with one cotyledon; 3 - seedlings without cotyledons (hypocotyl only) - [16]. The gaps remaining after the attack were measured, ranging in size from 20 to 100 $m^2$.

Damage during plant maturation was estimated according to the following scale: 0 - unattached caladium; 1 - 10% achenes consumed; 2 - 11% - 20% achenes consumed; 3 - 21% - 30% achenes consumed ... [16].

The economic damage was estimated by referring to the average/ha of the plot yield not attacked by birds, the market price in 2024, the costs of the applied technology and the damage caused by the birds. The profit was calculated considering the total area, total production, average production, selling price (lei), sales revenue and total costs/ha.

Plot A136 was harvested on 28.02.2024 and A519 at 10.09.2024 (Photo 2).

Photo 2. Plot harvesting, A 136, hybrid SY Futura AR, Cioreni
Source: Original photo by George Doru Laieș, 2024.

## RESULTS AND DISCUSSIONS

In plots located near Timisoara (A519 and A521), the severity of bird attacks was very high in 2024.

Plot A521 was the first to be attacked by *Columbidae* (*Columba livia livia*) and *Corvidae* (*Corvus frugilegus*). Immediately after sowing, hundreds of hungry birds consumed the seeds (Photo 3). Within a few days, the future sunflower crop was totally compromised. The same happened after the first and second reseeding. This plot was not cultivated with any plants in 2024 due to the birds' aggressiveness.

Photo 3. Birds attack in the plot A521, Timișoara
Source: Original photo by Cotuna Otilia, 2024.

Table 1. Yield, expenses, profit - plot A521, 2024

| | |
|---|---|
| Total surface ha | 2.5 |
| Total yield kg per plot | 0 |
| Average yield kg/ha | 0 |
| Selling price lei/kg | 1.8 |
| Selling income lei/ha | 0 |
| Total expenses lei/ha | 3,826.7 |
| Profit lei/ha | -3,826.7 |

Source: Own calculation.

Analysing the Table 1, it can be seen that the yield was 0 in plot A521, the expenses/ha amounted to 3,826.7 lei and there was no profit but only losses (Table 1). In the present case, the attack at the emerging stage totally compromised the crop (an exceptional situation). According to Clark *et al.*[4], the birds are attacking sunflower crops by feeding on seeds and young seedlings in the cotyledonal phase. The food of birds of the *Columbidae* family consists of seeds and grasses, whereas the *Corvidae* are omnivorous and opportunistic, being closely related to plant culture cropping systems, season as well as the resources available in the environment.

Early destruction of sunflower seedlings is an important problem for farmers in Europe, because they may stop growing sunflower crop [19].

Plot A519 located close to plot A521, was attacked by birds equally aggressively. After sowing, the seeds were consumed by birds.

The same happened after reseeding, similar to the neighbouring plot. After the second reseeding, the birds did not fully consume the seeds and cotyledons. The density at sowing was 67,000 germinable seeds/$m^2$, which means a density per $m^2$ of 6.7 plants. The evaluation made after the seedlings emerged, when the plants had regular leaves, showed that the plant density/$m^2$ was 1.6 plants. For satisfactory yield, the density should be at least 5 plants/$m^2$. For the experiment, the crop was maintained.

As a result of the attack during the seedlings' emergence period, 75% of the plants were lost. The remaining plants (25%) vegetated very well and formed large calatidia (heads). After flowering, birds (predominantly Corvidae) started to consume the achenes. A first assessment was made on 04.08.2024 when it was found that all the heads were attacked, with birds consuming the achenes at the edges. The percentage of attacks during this period was between 20 - 30%, missing seeds from the heads. The second assessment was conducted on 04.09.2024, before harvesting. The heads were missing 80% - 90% seed, some even 100%. Yield/ha was 277 kg/ha and total yield was 1,800 kg (on 6.5 ha).

Costs/ha were 3,826.7 lei and losses 3,328.2 lei. The sale was made at market price (1.8 lei/kg), yielding 498.5 lei/ha (Table 2).

Table 2. Yield, expenses, profit - plot A519, 2024

| | |
|---|---|
| Total surface ha | 6,5 |
| Total yield kg per plot | 1800 |
| Average yield kg/ha | 277 |
| Selling price lei/kg | 1,8 |
| Selling income lei/ha | 498,5 |
| Total expenses lei/ha | 3826,7 |
| Profit lei/ha | -3328,2 |

Source: Own calculation.

Photo 4. Gaps remained after the attack during the emerging of seedlings - plot A519, Timișoara
Source: Original photo by Cotuna Otilia.

The crop gaps were numerous and varied in size from a few $m^2$ to 100 $m^2$ (Photos 4 and 5).
Bird attacks were as aggressive as in spring (Photos 8, 9 and 10).

Photo 5. Gaps remained after the attack during the emerging of seedlings - plot A519, Timișoara
Source: Original photo by Cotuna Otilia, 2024.

In comparison to the average yield obtained in the 14.84 ha plot at Cioreni (2,670 kg/ha) which was not attacked by birds, the harvest of 277 kg/ha represents 10.37% of the crop potential under the climatic conditions of 2024.
Plot A136 of 14.84 ha from Cioreni was considered for the present study for comparison. The distance between this plot and the two near Timișoara was about 20 km. The plants emerged evenly and were not attacked by birds.

Photo 6. On each head is a bird, plot A519, Timișoara
Source: Original photo by Laieș Doru, 2024.

7

8

Photo 7 and 8. Heads before and after the attack at 6 August 2024, plot A519, Timișoara
Source: Original photo by Cotuna Otilia, 2024.

9

10

Photo 9 - 10. Heads without achenes on 4 Septembe 2024, plot A519, Timișoara
Source: Original photo by Cotuna Otilia, 2024.

The average yield/ha was 2,670 kg and the total yield was 39,623 kg. Under the conditions of 2024, when the sunflower yields at the national level were low, the one obtained in Cioreni was satisfactory bringing also profit (Table 3). Profit per hectare was 1,342.3 lei.

Table 3. Yield, expenses, profit - plot A136, 2024

| | |
|---|---|
| Total surface ha | 14.84 |
| Total yield kg per plot | 39,623 |
| Average yield kg/ha | 2,670 |
| Selling price lei/kg | 1.8 |
| Selling income lei/ha | 4,806.0 |
| Total expenses lei/ha | 3,463.7 |
| Profit lei/ha | 1,342.3 |

Source: Own calculation.

Statistical analysis was performed by calculating the standard error. The results are presented in Figures 1, 2 and 3.

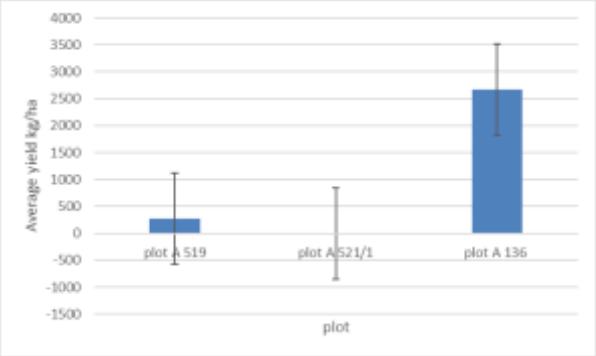

Fig. 1. Average sunflower yield (kg/ha) in the analysed plots - standard error displayed
Source: Own calculation.

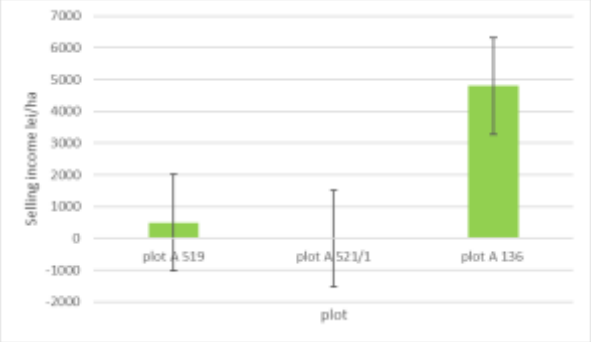

Fig. 2. Selling income (lei/ha) in the analysed plots - standard error displayed
Source: Own calculation.

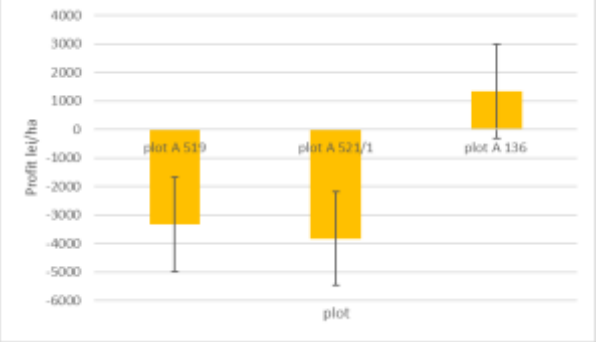

Fig. 3. Profit (lei/ha) in the analysed plots - standard error displayed
Source: Own calculation.

Bird damage to sunflower plots was 100% on 2.5 ha and 90% on 6.5 ha. Their location in the peri-urban area, nearby forest cover, and afforestation of some areas to create a natural habitat for birds are factors that led to the increase in bird populations. Birds are known to cause damage in all agricultural areas of the world. The results of the present study agree with the findings of other researchers. Gül *et al.* [9] reported damage ranging from 10 to 51.19% in sunflower crop.

According to Ilter [10], damage can increase by as much as 60% when crops are placed close to forests, hedgerows, and urban and rural settlements. Usually, damage does not exceed 38% according to Ilter [10].

In Romania, in the West, South and South-East [7, 8], in the last five years, bird (*Columbidae* and *Corvidae*) damage to sunflower crops (and not only) during germination and emerging is frequently reported. Whereas in the past birds were known to attack plants at maturity, consuming the achenes in the heads, damage during germination is now increasingly common. Farmers are often forced to reseed or even stop growing sunflower crop in certain areas, especially near urban settlements.

Saussa & Levy's review, published in [17], states that in Western Europe, "*damage that was once confined to mature sunflower plants is now becoming visible at seedlings emerging*". The same authors highlight from extensive documentation that we see a phenomenon in this regard. They argue that global climate change is influencing agricultural technologies and hence, the activity of agricultural pest birds. We agree with these points.

A current problem in the Banat Plain is that areas of agricultural land near towns often remain uncultivated due to bird attacks. Predominantly sedentary and opportunistic species of the families *Corvidae* and *Columbidae* have overpopulated and are continually multiplying because they easily find feeding and nesting sites in the areas around urban and rural settlements (households, garbage dumps, agricultural land, pastures, meadows, parks *etc*.).

The control methods used to remove birds from fields are no longer working. Nothing scares them anymore. *Corvidae* species that are recognized for their intelligence are coming to the fore. They can find freshly sown seeds with precision. They eat seeds and seedlings immediately after they've germinated. When the sunflower plants are mature, they eat the seeds and leave the husks in the heads and on the ground. By comparison, *Columbidae* species do not excel cognitively, relying more on their senses.

After sowing they consume young seedlings and cotyledons [5].

The economic losses in the fields studied are closely related to their establishment on land near Timisoara where birds are present year after year. Added to this is the fact that there is a nearby hedgerow where the birds can nest undisturbed.

## CONCLUSIONS

The economic impact of birds on sunflower crops is huge in the vicinity of towns, villages, forests, heaths etc. Year after year, farmers complain of economic losses, smaller or larger. The financial losses are closely linked to the location of the crops, the bird flocks in the area and their feeding sources.

Bird damage to two sunflower crops near Timisoara has been high, the crops being compromised. In the analysed area, such events occur yearly, irrespective of the crops. Attacks by *Corvidae* and *Columbidae* have become more frequent and aggressive in recent years in Banat, as populations have increased, especially those of *Columba livia livia* and *Corvus frugilegus*. Sunflower crops are much more vulnerable to bird attack and should, therefore, not be grown near inhabited areas.

In Romania, studies on the damage caused by birds to crops do not exist or if they do, they are not public, although the nesting areas of different bird species are known and maps exist.

Future studies are needed in all agricultural areas of Romania to estimate bird populations and the damage caused.

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