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A new method of controlling house sparrow damage to vineyards: Marginal planting of sunflowers

Mohammad Reza Raji*

Department of Horticulture, College of Agriculture, Lorestan University, Khoram Abad, 44316-68151, Iran.
**E-mail: raji.m@lu.ac.ir*

Abstract

Chemical pesticides used against house sparrows in areas where they cause significant damage to the quantity and quality of vineyard products can pollute the environment and harm the natural ecosystem. Sunflower seeds are a favourite food of house sparrows. The goal of this project, which lasted six years (2015-2020), was to see if marginal sunflower planting could reduce the amount of damage done to the vineyard crop by house sparrows. There was no marginal planting of sunflowers around the vineyard ('Red Raisin' cultivar) in the first three years of the experiment (2015-2017), and the sparrows damaged the vineyard crop by 32, 38, and 33 percent in 2015, 2016 and 2017, respectively. The vineyard had a large population of house sparrows at first. However, in the final three years of the experiment (2018-2020), when sunflowers were marginally planted (200 m^2) around the vineyard at a distance of 50 m, crop damage by sparrow beaks was 2, 4 and 2 percent in 2018, 2019 and 2020, respectively. During these three years, the vineyard's sparrow population was low, but the marginal sunflower field's population was high. Thus, results show that planting sunflowers in the margins of vineyards effectively reduces the damage caused by house sparrows.

Key words: Grape, sparrow damage, natural control, marginal sunflower planting

Introduction

Grapes (*Vitis vinifera*) are valuable commercial fruits worldwide. They are consumed fresh, dried, or processed (Aponso *et al.*, 2017), and are one of the world's most widely consumed fruits (Tarancón *et al.*, 2021). Unfortunately, both biological and non-biological stress have affected grape production. The damage caused by house sparrows (*Passer domesticus*), one of the most well-known sources of biological stress on grapevines, has received little attention in research on control measures and prevention (Lamelas-Lopez *et al.*, 2021).

House sparrows are a serious pest that wreaks havoc on corn and sunflower fields (Ahmad *et al.*, 2018; Jayewar *et al.*, 2018). Chemical (Hanson *et al.*, 2020) and physical (waves) (Fischer *et al.*, 2018) methods are both used to control this pest, but each has its own drawbacks. Chemical control causes environmental pollution and disrupts the balance of the ecosystem (Zaller, 2020). Although the effects of waves on the ecosystem have not been thoroughly studied, the effects are thought to be negative (Abate, 2020). Sunflower seeds are a favourite food for birds, both domestic and wild (Adeleke and Babalola, 2020). Sparrows strongly prefer sunflower seeds (*Helianthus annuus*), this study was inspired by the idea of planting sunflowers on the outskirts of a vineyard and then evaluating how likely the sparrows would choose sunflower seeds over the grape crop. The current study was based on a trial using sunflowers as a marginal planting around vineyards to divert birds away from the vineyards and instead attract them to the sunflowers, reducing bird damage to the vineyards.

Materials and methods

The research was carried out in a vineyard in Sefid Qaba village, Aligudarz county, Lorestan province. The grapevine cultivar was 'Red Raisin' and the total area of the vineyard was one hectare. The vineyard was established six years before this study began, and the grapevine was pruned yearly for uniform fruiting. The vineyard was fenced to prevent the entry of other pests such as foxes and stray dogs, so the experiment would sustain fewer errors. This research was conducted over six years, from 2015 to 2020. The 'Songhori' sunflower cultivar was used for marginal planting in an area of 200m^2 and 50 meters from the vineyard. Marginal planting was done in the last three years of the experiment (2018-2020) but none in the first three years (2015-2017) to make a comparison between the two conditions. The sunflowers were planted in a ridge-furrow pattern in mid-June so that the ripening of sunflower seeds would coincide with the ripening of grapes. During these six years, the damage done by house sparrows on the grapes was analyzed in terms of quantitative traits, *e.g.,* total vineyard yield, and qualitative traits, such as damaged grape clusters in a grapevine plant. This experiment was performed as a factorial in a completely randomized design, and data analysis was carried out by SAS software.

Results

The damage done by house sparrows was assessed both quantitatively and qualitatively. In terms of quantitative damage, the vineyard's overall performance and total yield were compared each year during the six years. The total yield of the vineyard, from the first to the sixth year was 15,500, 14,950, 15,800, 22,300, 21,800 and 23,900, respectively (Table 1). The vineyard yield was

significantly lower in the first three years of the experiment when no sunflowers were planted, compared to the last three years when sunflowers existed. The increase in vineyard yield in the last three years of the experiment was certainly caused by the marginal planting. To be more specific, product quality was assessed over six years. For six years, fifty grape bushes were selected for close examination. The average number of grape clusters and the average number of damaged clusters were examined. The number of damaged clusters in the first three years was more than in the last three years (marginal planting) (Table 1).

Table 1. Assessment of sparrows' damage to the vineyard crop during six years of testing

Characteristics evaluated	Overall garden performance (kg)	Total number of clusters of 50 bushes	Number of damaged clusters
First year	15500c	1126ab	359ab
Second year	14950c	1084ab	417a
Third year	15800c	1202a	397a
Fourth year	22300ab	1178ab	31cd
Fifth year	21800ab	1119ab	42c
Sixth year	23900a	1205a	29cd

This difference in the number of damaged clusters between the first three years and the last three years showed a significant decrease in sparrow damage to grape clusters in the second three years (Fig. 1). The total number of clusters did not differ significantly throughout the six years. The number of damaged clusters was significantly higher in the first three years than in the last three years. Since the total number of clusters did not differ during the six years, whereas the number of damaged clusters did, the difference in yield can be attributed to the damage done by sparrows (Figs. 2 and 3).

Field observations showed that the sparrows were the only fauna that visited the vineyard in the first three years. The presence of other birds and unwanted insects was negligible. The total number of clusters, from the first to the sixth year, was 1126, 1202, 1084, 1118, 1179 and 1205, respectively, which did not differ significantly throughout the years. In contrast, the number of damaged clusters in the first to sixth years was 412, 359, 421, 42, 31 and 29, respectively, which shows how the last three years had far fewer damaged clusters. To arrive at a relative description of the damage, the number of damaged clusters was divided by the total number of clusters in the same year, and each result was multiplied by 100. Accordingly, the first to the sixth years sustained damages of 32, 38, 33, 2, 4 and 2 %, respectively.

Discussion

According to the results, the effects of sunflowers by marginal planting in the last three years significantly reduced the damage and increased the vineyard's yield. In this applied research, an environmentally-friendly approach was used as an alternative to chemical toxins and other ineffective methods. Without damaging the ecosystem, this beautiful bird was kept away from the vineyard by providing them with their favourite food, *i.e.* sunflower seeds. Instead of entering the vineyard, the birds spent time in the marginal sunflower field for food. So far, no research has been done on marginal sunflower planting for this purpose, whereas previous research used methods such as waves, trapping, and chemical toxins. Meheotra *et al.* (1967) investigated the lethal effects of melatonin on the house sparrow and showed that 10 mg of the chemical could kill the bird. Hothem and Dehaven conducted an experiment using a hawk-kite resembling an immature golden eagle suspended from a helium balloon.

Fig. 1. Effect of reducing the damage of house sparrows to the vineyard crop in the second three years of the experiment when marginal sunflower planting was performed.

Fig. 2. Effect of house sparrow damage on vineyard crop (red raisin cultivar)

Fig. 3. Attack of house sparrows on a sunflower field planted on the edge of a vineyard in the second three years (2017-2020).

While the results showed a slight decrease in grape damage, the effectiveness was limited to a small area, with damage increasing in other parts of the vineyard as the birds got used to the sound effects. However, some of these methods, despite being effective, can cause harm to the ecosystem and natural environment. On the other hand, the marginal planting of sunflowers is an environmentally-friendly option that may even contribute to the local ecosystem's balance.

The results showed a substantial decrease in crop damage (3-4%) by house sparrows. In contrast, the experiment without sunflower planting experienced damage percentages ranging from 32% to 38%. The study demonstrated that the use of chemical pesticides was unnecessary and detrimental to the ecosystem. Instead, marginal sunflower planting provided an effective and environmentally friendly solution to protect vineyard, while also supporting a healthy population of house sparrows in the nearby sunflower field.

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