Effects of Multifunctional Margins implementation in annual crops on biodiversity

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Introduction

Sustainability of rural world require makes a change from agricultural intensification to ecological intensification. This process reduces the use of agricultural inputs and increasing biodiversity in the orchards, helping the farms sustainability. Ecological intensification seeks to go wild again agriculture, retrieving the elements that agricultural intensification has subtracted agri-ecosystems in recent decades. Ecological intensification in cultivated land promotes the use of Multifunctional Margins (Picture 1). Their implementation in annual crops is considered an important tool for increasing biodiversity in agricultural land. Increase biodiversity, in addition to its intrinsic value, provides ecosystem benefits, such as improvement in crop pollination, fight against pests and regulation of nutrients cycle. In addition to connect natural areas, creating ecological corridors. Multifunctional Margins establishment can be done by letting adventitious vegetation grow, or by using sown species. Often, only seeds that have survived years of tillage and herbicide treatments remain in the soil and tend to pose a high risk of infestation to the crop. The implantation of seeded Multifunctional Margins establishes a process of competition between with weeds, limiting their presence.

Picture 1. Multifunctional Margin

Material and methods

In order to know the effect of Multifunctional Margins implementation on biodiversity, the planting of 3 types of Multifunctional Margins (Table 1), with different herbaceous composition for each of them was performed during the 2018-2019 agricultural campaign. With the purpose, not only to assess what floristic composition contributes to greater biodiversity, but also, what results it throws on a control margin of spontaneous flora. For this, the experience has been replicated in 4 farms located in the province of Seville (Spain) (Figure 1). In each farm, two plots have been established for each of the types of margins studied, with the intention of obtaining statistically significant data. For each plot, the Shannon Biodiversity Index on the flora, on the arthropods that inhabit the plant species (aerial fauna) and on the arthropods that live on the soil (epigeal fauna), has been calculated.

Table 1. Sowing percentages in sown Multifunctional margins

Margin 1	Margin 2	Margin 3
Brassica napus (20%)	*Sinapis alba* (10%)	*Sinapis alba* (20%)
Coriandrum sativum (30%)	*Coriandrum sativum* (25%)	*Coriandrum sativum* (25%)
Lupinus luteus (5%)	*Salvia verbenaca* (10%)	*Salvia verbenaca* (5%)
Onobrichis viciifolia (5%)	*Medicago sativa* (5%)	*Medicago sativa* (10%)
Trifolium resupinatum (10%)	*Chrysanthemum coronarium* (5%)	*Trifolium resupinatum* (15%)
Trifolium suaveolens (10%)	*Borago officinalis* (15%)	*Borago officinalis* (30%)
Vicia sativa (20%)	*Vicia sativa* (30%)	*Ononis natrix* (5%)

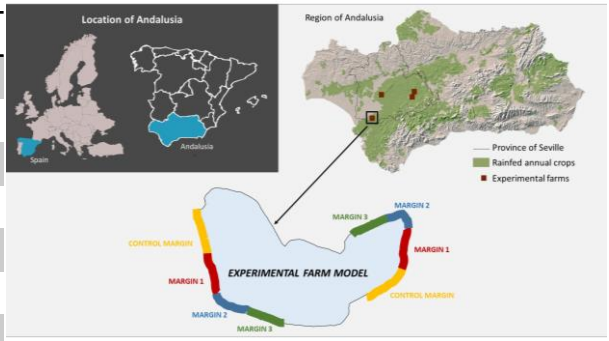

Figure 1. Locations and experimental model

For the evaluation of the results, various aspects have been taken into account to weigh the Shannon biodiversity index. As for the flora, the biodiversity of species that can serve as food for pollinating insects has been positively valued. While a negative value has been given to the presence of those that are potentially susceptible to invade the crop. Likewise, the biodiversity of pollinating insects within the aerial fauna has been valued to a greater degree than that of those who do not have this quality. Taking into account these variables (flora, aerial fauna and epigeal fauna) has been obtained a global result by margin type on a scale of 0 to 10.

Results and discusión

Flora biodiversity results show the existence of a greater heterogeneity of plant species in the planted margins. This may be due to the powerful colonization of weeds that occurs in the control margins. Within the planted margins, the greatest plant biodiversity falls on margins 1 and 3. While Margin 2 has somewhat lower levels of flora biodiversity. Margin 1 has shown a better disposition to host a greater biodiversity of aerial fauna with respect to the rest. On the other hand, Margin 2 is the one that has shown the best results in biodiversity in terms of the presence of epigeal fauna. Subsequently, the average value of the three variables has been calculated, to obtain a global result that defines the qualities of the margin in terms of biodiversity (Figure 2). The results reflect that the seeded Multifunctional Margins have a greater interest for their implantation, than those grown spontaneously. Specifically, the overall assessment of the four margins has been: Margin 1 (7.16), Margin 3 (7.04), Margin 2 (6.85) and Control margin (6.24).

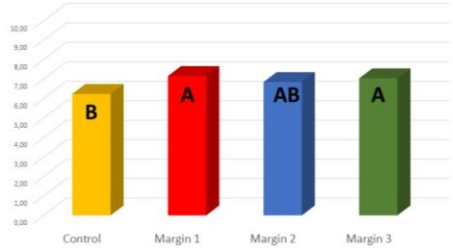

Figure 2. Total average in biodiversity. The letters represent significant differences in LSD test.

Conclusions

The monitoring of different biodiversity aspects (flora, aerial fauna and epigeal fauna) in Multifunctional Margin, made it possible to demonstrate its implication in improving biodiversity in agri-ecosystems. In particular, better results have been observed in planted margins than in those in which spontaneous flora has been allowed to grow. In this sense, a work of this type makes it possible to corroborate that the implementation of Multifunctional Margin must be a necessary eco-scheme within future European agricultural aid.

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