National scale impacts of agricultural practices on ecosystem (dis)services of field margin vegetation

Léa Genty*[1], Christine Meynard[2], Marie-Charlotte Bopp[2], Laura Henckel[3], and Guillaume Fried[1]

[1]Anses, Laboratoire de la Santé des Végétaux, Unité Entomologie et Botanique, Montferrier-sur-Lez – Agence nationale de sécurité sanitaire de l'alimentation, de l'environnement et du travail – France

[2]Centre de Biologie pour la Gestion des Populations – Centre de Coopération Internationale en Recherche Agronomique pour le Développement, Institut de Recherche pour le Développement, Institut National de Recherche pour l'Agriculture, l'Alimentation et l'Environnement, Institut Agro Montpellier, Université de Montpellier – France

[3]Agroécologie [Dijon] – Université de Bourgogne, Université Bourgogne Franche-Comté [COMUE], Institut National de Recherche pour l'Agriculture, l'Alimentation et l'Environnement, INSTITUT AGRO DIJON – France

Résumé

Agricultural field margins provide food and shelter for plant and animal species in agricultural landscapes, and can increase connectivity, including for rare or threatened species. This habitat also delivers major regulating ecosystem services, such as pest control or pollination support. However, these services have been studied mostly at a small temporal or spatial scale, focusing only on one service or on one crop. Disservices, i.e. potential negative impacts of field margin vegetation on agricultural production, have been rarely considered so far.
To understand how ecosystem (dis)services are impacted by agricultural practices at a large scale we used a nationwide monitoring network composed of 500 sites located all over France. Both agricultural practices and biodiversity were monitored yearly for 5 years between 2013 and 2018. This network is representative of the three French major crop types: cereals (wheat and maize), vineyards and market gardening. We focused on the effects of pesticides use (at both landscape and field level) and of agricultural practices of both the margin and the field, on four ecosystem (dis)services delivered by field margins: provision of floral resources for pollinators, erosion control, plant conservation, and the disservice of maintaining problematic weeds in the margin.

We hypothesized that pesticides use would negatively impact services by reducing plant abundance at both field and landscape scale. Additionally, fertilization would increase the presence of competitive and ruderal common agrotolerant plants. In conjunction with in-field pesticide use, this would positively affect disservices, as problematic weeds are mostly fast growing ruderal plants.

We found that impacts of practices were dependent of the agro-bio region studied. In areas dominated by vineyards, with warmer climate and less fertile soils, in-field herbicide use

*Intervenant

always decreased the delivery of services while it increased the disservice of hosting problematic weeds. On the contrary, in the regions dominated by intensive cereal cropping systems with higher herbicide use, the impacts on the services were mostly due to the pesticides at the landscape scale. We also found that nitrogen fertilization decreased the presence of floral resources in the field margin, though threatening pollination in agricultural landscapes.
This study demonstrates that intensive agricultural practices decrease service delivery while increasing disservice, as supposed and already found by more spatially or temporally restricted studies. Finally, we also found that these impacts both depend of local or landscape practices according to the region or the studied agroecosystem. To favor services delivery, solutions have to be managed at both local and regional scale.

Mots-Clés: pesticides impact, field margin, ecosystem services, floral resources, agrobiodiversity