Pesticide use and large field size limit natural pest control services in vineyard landscapes

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Résumé

Crop pests are a major threat for food security, as 20% of worldwide crop production is destroyed by insect pests each year. Pest control has been mainly supported by the use of pesticides; however, concerns regarding their adverse effects on human and ecosystem health are rising. In addition, there is a general consensus that extensive use of pesticides could lead to decreasing levels of biodiversity with major negative impacts on agroecosystem functioning. Pesticides may have negative feedbacks on the long run, enhancing pest outbreaks through their impacts on natural pest control services. However, how changes in farming practices and landscape context affect the mean and the stability of pest control services in agricultural landscapes remain poorly understood.
Several variables operating across various scales affect natural enemy communities that support the delivery of pest control services. Landscape context shape natural enemies' species pool able to colonize crop fields and farming practices act as local filters explaining local species assemblages responsible for natural pest control. While studies have suggested interactive effects of landscape context and local management on natural pest control, results are often contrasted and rarely evaluate their consequences on the spatiotemporal stability of this ecosystem service.

Here, we used vineyard-dominated landscapes in the southwest of France to investigate how landscape context in interaction with pesticide use affect pest control services and its stability. We evaluated natural pest control by assessing predation rate of eggs of the grape moth *Lobesia botrana*. We predicted that less intensive farming practices, with lower use of pesticide and a lower number of passages in the vineyards would increase the intensity and stability of predation rate. Additionally, we expected that more complex landscape would favours natural enemies population and would lead to greater pest control.

We found that mean pest predation rate per day decreased with increasing treatment frequency. Additionally, predation rate was lower in less complex landscape, with enhanced field size. Finally, we did not find any effect of agricultural practices or landscape on the stability of predation rate across year.
Together, our results suggest that natural pest control services could be increased both by

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less intensive management and by increasing landscape heterogeneity by reducing average field size. Further research are now needed to assess the trade-off between a reduction in the use of pesticides, an increase in natural enemies' activity and the impacts it can have on pest damage and crop yields in agricultural landscapes.

Mots-Clés: Farming practices, Pesticide, Landscape, Natural pest control, Vineyard