Assessing non-intended effects of farming practices on field margin vegetation with a functional approach

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Abstract

To assess the unwanted side effects of farming practices, we used a nationwide survey of the vegetation of arable field margin strips. The vegetation was surveyed during two years in 430 field margins distributed over all regions of France. We used two complementary trait-based approaches to examine how ten plant traits were related to ten environmental variables describing abiotic conditions, landscape factors, field margin management and in-field practices. Generalized additive mixed models were developed to assess how the same environmental variables correlated with species richness and functional diversity. Our study highlighted that the composition and the diversity of vegetation in arable field margins were primarily driven by the direct field margin management and by landscape factors. However, among farming practices, distinct non-intended effects of fertilization and herbicides were highlighted. The level of nitrogen fertilizers had the strongest effects on the functional composition of field margin vegetation with a change toward more nutrient-demanding species, while the intensity of herbicides use was related to a slight decrease in species richness with no effects on functional composition or diversity. Species depending on animals for their reproduction (obligate entomogamous species) or for their dispersal (zoochorous species) were associated with smaller less intensively managed fields in landscapes with a high proportion of non-arable habitats. Some of the observed patterns seemed to be driven by differential responses of agrotolerant versus hemerophobic species, with the latter being more species-rich under organic than under conventional farming. Despite efforts to reduce nitrogen inputs since the 2000s, our results shows that N-fertilization still has significant non-intended effects on field margin vegetation. These first results show the usefulness of this new network of fields ("500 ENI") set up by the Ministry of Agriculture in order to monitor biodiversity in relation to farming practices, especially use of agrochemicals.

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