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Herbicide reduction can preserve crop yields as well as biodiversity benefits of weeds

Pesticide-sparing approaches to farming do not have to compromise on crop yields, new research suggests. A study that explored the impact of reduced herbicide use across a variety of different farming contexts found that herbicide-efficient systems could be just as productive as conventional systems — and more so than organic systems — whilst having other important environmental benefits.

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Contact:
sandrine.petit2@dijon.inra.fr

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Ecological intensification is an approach to farming that, instead of focusing solely on increasing yields, favours practices that maintain or increase yields whilst also considering the impacts on the environment and, in particular, biodiversity. The careful treatment of weeds is an important consideration in ecological intensification, since weeds can help to create more diverse habitats for wildlife, and may contribute to crop pollination and pest control on farmed land. From a farmer's point of view it may be beneficial to apply less herbicide in order to preserve some of these useful functions. However, a balance must be struck between reducing herbicide use and crop losses due to weed infestations.

To understand more about the appropriate balance, the researchers carried out studies in 55 experimental and agricultural fields across France between 2000–2010. The studies covered a wide range of crops and methods, including field observations, farmer surveys and modelling of weed growth and functions across different farming systems. Farming systems were grouped into conventional farming, organic farming and integrated pest management (IPM) or herbicide reduction approaches. Organic and IPM systems both use alternative practices based around soil tillage regimes, sowing dates and mechanical weeding to reduce herbicide use.

Overall, the results showed that IPM systems were more sustainable and environmentally friendly than the other types of systems, and suggested that using less herbicide does not necessarily lead to lower yields. As long as farmers combine herbicide reduction with other land management strategies that control weeds, they can produce similar yields whilst also improving the sustainability of their farming practices. No major weed outbreaks occurred in the studies and the modelling results suggest that alternative weed management practices resulted in potentially important biodiversity impacts.

It was common for IPM systems to reduce reliance on individual crops by growing more than one crop — known as crop diversification — and this seemed to allow reduced herbicide use without reducing productivity. However, in an extreme version of IPM, which completely banned herbicides, weeds did increase significantly. The researchers suggest therefore that it may not be sustainable to eliminate herbicides altogether due to the potential crop losses.

The researchers used performance indicators to compare the different farming systems. Indicators covered herbicide doses, energy usage and efficiency, fuel consumption, fertiliser use, pollution due to herbicide use and economic sustainability including profitability. IPM systems generally performed better across indicators of sustainability and environmental effects, whilst producing crop yields similar to conventional systems; organic systems could not match them for productivity. Profitability was similar across the three types of system.

According to the researchers, the results present IPM as a promising approach to reducing herbicide use in farming, which takes up less land than organic farming through its higher productivity levels. They suggest setting up a monitoring network to test the long-term effects of herbicide reduction across different farming contexts. However, they stress that their study does not comprehensively assess the contribution of weeds to biodiversity. This is because current understanding of the benefits and feedbacks associated with weed diversity is poor and the degree of complexity high. The researchers call for more research on weed functions in farming and in particular on the effects of different crop systems on biodiversity.