

# Can legumes solve environmental issues?

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A field of peas. Credit: Moritz Reckling

It's a win-win situation for the environment and the economy when it comes to introducing legumes into agricultural systems, says new research published in *Frontiers in Plant Science*, carried out by an international team of scientists as part of the European Union project, Legume Futures.

Currently Europe's [crop production](#) is highly specialized in only a small number of [plant species](#), to the detriment of the environment. Cereal crops dominate, meaning Europe imports over 70% of its protein feed stocks to support the meat industry.

"The introduction of legumes such as clovers, lupins, lucerne and faba beans can increase the sustainability of agriculture and the supply of protein in Europe," stated Moritz Reckling of the Leibniz Centre for Agriculture Research (ZALF) in Germany and lead author of this study. Legumes are protein-rich and would provide relief for the deficit; they also increase the amount of nitrogen available to plants through biological nitrogen fixation, reducing the need for fertilisers.

With less than 2% of European arable land currently used to grow grain legumes, Reckling and co-workers created a model to determine the effects of integrating legumes into cropping systems. The team set out to evaluate the trade-offs between environmental and economic effects of legume integration.

To demonstrate applicability in different regions, they used five case study areas in Europe with contrasting climatic conditions and cropping systems. Reckling explained: "legumes are seen to be generally beneficial to the environment, but they are not economically attractive to farmers when compared as single crops, so we wanted to look at the gross margins of crop rotations when legumes are integrated".

The team confirmed the environmental benefits to introducing legumes and found that in such cropping systems, overall nitrous oxide emissions reduced by approximately 20-30% and fertilizer use was down by 25% to almost 40% in some cases. The systems developed did not show increased nitrate leaching into groundwater supplies, and in some systems with forage legumes leaching was even reduced.

Most significantly, the gross margins evaluated show an increase in all of the forage agriculture systems modelled, and in two out of the five arable systems. "When comparing the trade-offs between environmental and economic effects, the study shows that positive environmental effects do not necessarily mean that gross margins go down," concluded Reckling.

Contrary to popular belief, these findings show that the benefits of diversifying cropping systems through the inclusion of legumes can be both environmental and economic. Based on real case-study regions, the results demonstrate great potential for implementation.

The study also supports the recent reforms to the European Union's Common Agricultural Policy that promote the reintroduction of legumes into [cropping systems](#). Through the effects of these incentives and increased awareness, the percentage of [legumes](#) grown on arable land is already beginning to rise. To provide further recommendations and support for farmers, research into the high variability of legume yields in the context of climate change adaptation is currently underway as part of the European project, Climate-CAFE.

**More information:** *Frontiers in Plant Science*, [DOI: 10.3389/fpls.2016.00669](https://doi.org/10.3389/fpls.2016.00669)

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