Ecological intensification of agriculture

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The larva of chrysopidae with its prey, a potato aphid; biological pest control using natural predators boosts yields and benefits additionally from reduced tillage and landscapes of great structural diversity. Credit: Matthias Tschumi

Putting a halt to the profound changes affecting agricultural landscapes: With this goal in mind, scientists, farmers and official representatives

teamed up to look into ecological intensification as a potential solution.

Agricultural landscapes in Germany have lost much of their diversity being dominated by crops such as maize and rapeseed today. This trend has also had an impact on the biodiversity of animals and wild plants and the consequences of excessive pesticide and fertiliser use are beginning to show as bees are dying and excess nitrate concentrations are threatening groundwater and drinking water.

Experts from science and agriculture are calling for an end to such practices. "Research has shown that the agricultural landscapes are still transforming unchecked," says ecological scientist Sarah Redlich from the Biocenter of the Julius-Maximilians-Universität Würzburg (JMU) in Bavaria, Germany. This has a detrimental impact on the environment, yields and the sustainability of farming.

Creating high-yield and sustainable agricultural ecosystems

Scientists believe that this negative trend can be reversed through the concept of ecological intensification. The underlying idea is to integrate ecological processes such as pollination and predator/prey systems into agricultural practices and manage them selectively. They are confident that this will help reduce the use of insecticides and fertilisers. Ideally, this approach should lead to the creation of agricultural ecosystems that provide high yields while being sustainable and satisfying society's standards in terms of environmental protection, aesthetics and the production of healthy foods.

What does ecological intensification look like in practice? The concept is based on hedges, field strips with flowering plants, crop variety and special cultivation methods that eliminate soil-turning tillage, for

example. Taken together, these measures promote biodiversity, support pollination and fight pests by using their natural enemies. These assumptions are backed by the results of the LIBERATION research project headed by Professor Ingolf Steffan-Dewenter and located at the Chair of Animal Ecology and Tropical Biology in the JMU's Biocenter.

The European Union funds the project with three million euros of which 350,000 euros are allocated to the research activities at the University of Würzburg. Building on two predecessor projects, the venture also breaks new ground. In addition to laying the scientific foundation of ecological intensification, the project prioritises the communication of the research results to the public.

PhD students engage with agricultural experts

Passing on knowledge, getting feedback, strengthening cooperation and defining joint targets – Sarah Redlich and her colleague, agricultural scientist Audrey St-Martin from the Chair of Animal Ecology and Tropical Biology, devised this agenda to hold a series of events related to the topic "Integrating ecological processes in conventional agriculture – an opportunity or contradiction?"

Wild bees and honeybees perform valuable pollination work in agricultural landscapes. They play an important role in ecological intensification: Flower strips and semi-natural habitats promote pollinators. Credit: Giovanni Tamburini

The two PhD students accompanied by other Chair experts participated for example in the agricultural exhibition organised by the German Agricultural Society in Mariaburghausen in the Haßberge rural district. Moreover, they gave lectures and organised two workshops at an agricultural farm in Güntersleben (rural district of Würzburg).

The events were met with much interest. "During the three-day agricultural exhibition alone, around 2,000 of the 22,000 visitors visited

our stand and about 200 of them stayed longer to learn more about research results or get information about the workshops," Redlich says.

The audience was varied including representatives of the Lower Franconian government, of the landscape conservation association, of the Departments for Food, Agriculture and Forestry and of the Bavarian farmers' associations plus agricultural vocational teachers and, of course, farmers.

Need for flagship farms and red tape reduction

One thing became clear very quickly: There is huge need for action and the will to change things together to implement more sustainable and ecological agricultural practices. To achieve this goal, continuous cooperation between the university, farmers and governmental authorities is required. "We also need flagship farms. They can be incentives to adopt measures in one's own business," a farmer association representative comments.

At the same time, red tape needs to be cut because it frequently curbs the enthusiasm of many farmers in its early stages. The PhD students exemplify the problem: A lot of farmers who had planted flower strips as part of the Bavarian cultural landscapes programme (KULAP) would probably no longer do so under the new KULAP programme. This is because the application process has become more complex and they are facing even more bureaucracy. "Among others, farmers are now required to map the flower strips accurately. This is a very time-consuming task and involves the risk that minor charting errors are sanctioned because of incorrect data or too large areas," Redlich explains.

Hands-on experts involved

Chair head Professor Ingolf Steffan-Dewenter and the two scientists agree that "the events were a huge success". They attribute this success also to two persons they took on board already during the planning stage: Werner Kuhn, a farmer who hosted the workshops on his company premises in Güntersleben and who is the co-founder of the "Lebensraum Feldflur" network and Anne Wischermann from the Department of Food, Agriculture and Forestry in Karlstadt who is a wildlife habitat consultant responsible for the preservation, improvement and creation of habitats for wild animals.

These two experts see ecological intensification from a different, non-scientific viewpoint. "Without them, this part of the project would not have been as successful as it has been," the Würzburg PhD students emphasise. Together, they managed to shed light on all aspects of the problem, namely the scientific, agricultural and legislative side. At the same time, they provided valuable input to promote more sustainable farming practices.

Provided by Julius-Maximilians-Universität Würzburg