Diversifying crop fields reduces pest abundance, study finds

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Intercropping—the practice of planting mixtures of crops—can be an

effective pest management tool worldwide, a new University of Florida study published in the *Journal of Applied Ecology* shows.

The analysis compiled results from 44 field studies across six continents and focused on four crop types—cabbage, squash, cotton and onion—planted on their own and mixed with a companion plant species. In these studies, scientists recorded 272 total occurrences of 35 different species of plant-eating insects on crops, representing one of the most comprehensive evaluations of intercropping effectiveness across the globe.

"Overall, intercropping proved to be very effective against pests, but it did vary based on the pest and their feed preferences," said Philip Hahn, assistant professor in the UF/IFAS entomology and nematology department, who led the study. "It also depended on crop type, with cabbage and squashes showing the strongest resistance, while resistance was less strong for onions and cotton."

There are a few common methods of intercropping. Sometimes non-cash crops are arranged in borders surrounding the field to repel or intercept pests before they damage the cash crop. Companion plants can also be planted within the field to disrupt pests from locating the main crops. A common combination is known as the Three Sisters: corn, squash and beans. Another of this study's findings was that interspersed planting schemes, like the Three Sisters, make it more difficult for the pests to locate their preferred host plant and were more effective than border plantings.

"In the studies we examined, we found intercropping was more effective for generalist pests that feed on a variety of crops," Hahn said. "Specialist pests that target one type of crop were less affected." Specialist pests usually have a long history of co-evolution with the plants they target and therefore may be less influenced by the presence

of a neighboring companion plant.

Researchers have long been interested in studying the value of intercropping systems, providing an abundance of previously published data. Hahn included studies from those earlier analyses, plus more recent studies, which allowed for a comprehensive evaluation of the conditions that best promote the benefits of intercropping.

While variability proved to be a common thread across studies, Hahn noted that a geographical pattern arose, however weakly.

"We did find a stronger benefit for pest suppression at lower latitudes—so, in tropical systems versus northern temperate systems," Hahn said. "There are lots of reasons we could have found that pattern, of course; the tropics are places where there tend to be more species of insects year-round. It was surprising that the pattern was not as strong as I would have expected."

This analysis will likely inform future investigations, Hahn said, as neighboring plant selections could be the key to success in intercropping systems. The new research provides recommendations for piecing together the most effective companion plantings, while also highlighting pairs that seem to be less effective.

"There are a few combinations that seem to be particularly effective at reducing pest abundance," Hahn said. "Overall, for growers interested in organic methods, intercropping seems to be a very effective tool."

More information: Philip G. Hahn et al, Environmental context and herbivore traits mediate the strength of associational effects in a meta-analysis of crop diversity, *Journal of Applied Ecology* (2023). DOI: 10.1111/1365-2664.14382

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