

Disease-resistant rice and wheat plants may modulate disease susceptibility in their neighbors

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Rice paddy fields in the Yuanyang terraces, a place where elevated rice diversity is grown and who inspired the researchers' work. Credit: Jean-Benoit Morel (CC-BY 4.0, creativecommons.org/licenses/by/4.0/)

Growing several plant varieties in the same field for disease resistance is a longstanding agricultural practice, but can have unpredictable results.

A study published September 12th in the open access journal *PLOS Biology* by Jean-Benoit Morel at Institut National de Recherche pour l'Agriculture l'Alimentation et l'Environnement, Montpellier, France, and colleagues suggests that plant-to-plant interactions may confer disease immunity in both wheat and rice.

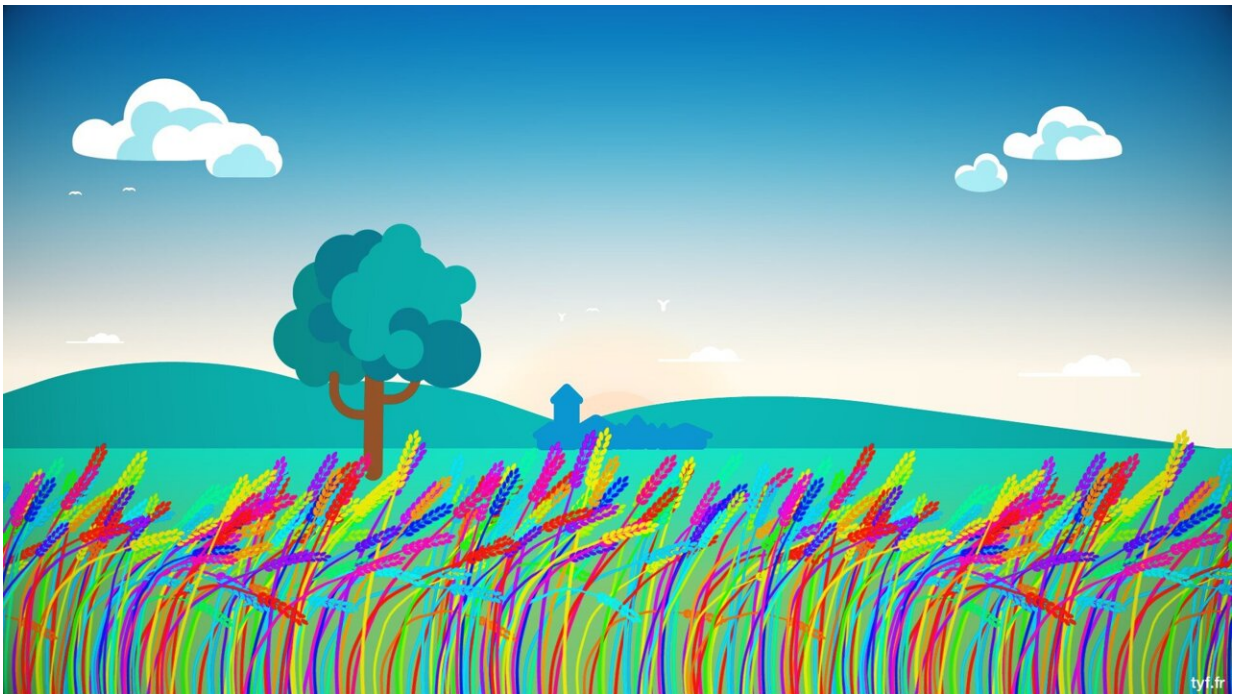
Neighbor-modulated susceptibility (NMS) occurs when healthy, same-species neighbor plants modulate basal immunity and susceptibility to [pathogens](#). However, NMS is not well understood.

In order to evaluate NMS' potential to reduce the spread of plant pathogens, researchers measured disease susceptibility in 200 pairs of rice and durum wheat varieties. They selected one set of genotypes composed of selectively bred varieties and one from populations that had not undergone modern selection. The pairs of same-species variety mixtures grown in pots under controlled greenhouse conditions were inoculated with fungal foliar pathogens, and disease susceptibility was monitored before any possible pathogen dispersal.

Using a [statistical model](#), the authors were able to quantify the relevance of NMS and the relative contribution of neighbor effect on pathogen susceptibility in varietal mixtures.

The researchers identified 23 same-species mixtures (~11%) where plant-to-plant interactions modulated disease susceptibility, suggesting that Neighbor-Modulated Susceptibility is a relatively frequent phenomenon. They observed both positive and negative effects of the neighbors, indicating that the consequences of plant-to-plant interactions can be variable.

The study had several limitations, for example, only two crops, rice and wheat, were tested. Additional future studies may include [field trials](#), where plants are subjected to a range of outdoor conditions, rather than grown in a greenhouse.



Researchers find that disease-resistant rice and wheat may modulate disease susceptibility in neighboring plants. Credit: David Ritter (CC-BY 4.0, creativecommons.org/licenses/by/4.0/)

According to the authors, "These findings open new avenues to develop more sustainable agricultural practices by engineering less susceptible crop mixtures thanks to emergent, but now predictable properties of mixtures. Our study suggests that the indirect effects of plant-plant interactions on pathogen [susceptibility](#) could be used to design varietal mixtures with embedded crop protection."

Morel adds, "In animals and in particular herds, it is commonly observed that individuals adjust their functioning according to their neighbors, in a way that benefits the group but not necessarily to each individual. This work shows that such a phenomenon exists in plants, suggesting in that case that plants regulate their immunity at the [population level](#), opening new perspectives for crop and ecology research."

More information: Pélissier R, Ballini E, Temple C, Ducasse A, Colombo M, Frouin J, et al. (2023) The genetic identity of neighboring plants in intraspecific mixtures modulates disease susceptibility of both wheat and rice. *PLoS Biology* (2023). [DOI: 10.1371/journal.pbio.3002287](#)

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