GM wheat that emits pest alarm signals fails in field trials

Wheat modified to send out insect pheromones does not repel aphids.

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Rothamsted Research

The GM wheat in fields at Rothamsted, UK.

A pioneering genetically modified (GM) wheat crop that emits an insect alarm pheromone to ward off pests has not worked in field trials, disappointed researchers say.

Scientists at Rothamsted Research, an agricultural science institute north of London, had hoped that promising experiments in the laboratory[1] — where the wheat did repel damaging aphids — would translate into the field, and would mean that crops could be grown using less insecticide.

“The disappointing thing was when we tested it in the field we didn’t find any significant reduction [in aphids]. We didn’t get the result that would have been useful in taking this forward,” says Toby Bruce, a chemical ecologist at Rothamsted. “It was quite sad.”

The field trials, whch started in 2012, attracted notoriety when anti-GM protestors threatened to destroy the crop and staged protests at the Rothamsted site. The protests did not disrupt the research, but making the site secure added around £1.8 million (US$2.8 million) to the study's research cost of £732,000.

The levels of aphids seen in the field trials were low — so low that the wheat might not have needed to be sprayed with pesticides had it been a commercially planted field, the Rothamsted team says in a paper published today in *Scientific Reports*[2]. But compared to a control crop of wheat, the GM crops showed no improved yields, no reduction in aphids and no increase in attacks by aphid predators (such as parasitic wasps and ladybirds).

“The field is the ultimate arbiter,” says John Pickett, a chemical ecologist who led the work. “This hypothesis was tested false.”

Try, try again

Pickett says that the researchers are not abandoning the pheromone idea altogether, because there are reasons to believe that it might work if the field trial is modified.

François Verheggen, who works on insect pheromones and pest management at the University of Liège in Belgium, says that it takes high levels of alarm pheromones to attract aphid predators. The pheromones emitted by the wheat in the Rothamsted trial would have reached sufficient levels only after around 71 days, leaving crops unprotected before then, he says. And, he adds, because the wheat in the trial released pheromones continually, the aphids might have become used to the signal. Aphids are repelled when they sense strong differences in pheromone emissions between one area and the next, he says.

The Rothamsted team plans to modify their crop to emit the pheromone in a burst — simulating natural release — rather than continuously. They may also try to test the crop in areas that have much higher concentrations of parasitic wasps, Pickett says.

Jonathan Gershenzon, who studies plant chemistry at the Max Planck Institute for Chemical Ecology in Jena, Germany, says that he would not have expected continuous emission of a pheromone to work. His team has previously shown that a transgenic version of the flowering plant *Arabidopsis thaliana*, which emits an alarm pheromone, is not protected against aphids[3].

“It was good that they tried. It’s a different system with wheat, it’s a different aphid,” and they did it in field conditions, he says. “I give them lots of points for trying and even more points for being willing to publish negative data. It shows how science can work.”

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References

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