Can farmers reduce toxic agricultural chemicals by tricking pests with pheromone-producing biotech plants?

What if, instead of killing pest insects with toxins, we simply tricked them into not harming our crops? That's the idea behind the use of pheromones to trap pests. A study published in *Nature Communications* outlines a technique to engineer tobacco plants to produce the sex pheromones of a pest moth species to confuse males and render them harmless. This research eventually could have significant repercussions for farmers committed to reducing the use of expensive and potentially harmful toxic pesticides.

Pheromones have become a popular technique for pest management in recent years, according to a report on the experiment in ScienceNOW, because of their relative ecological safety (they don't have as large or destructive an effect as pesticides) and their extreme potency (ten grams is sufficient to protect a full hectare of crops).

For nearly 4 decades, nontoxic and biodegradable synthetic pheromones have been a tool in farmers' arsenals, but they come with drawbacks: "their production often involves use of harmful chemicals, such as the neurotoxins hexane and dichloromethane."

To be clear, this study was simply a proof-of-concept experiment meant to demonstrate that plants could be used as biofactories to produce organic versions of insect pheromones. A team led by Christer Löfstedt, chemical ecologist at Lund University, genetically modified a tobacco plant to produce the sex pheromones of two different pest moth species. They then extracted the chemical from the plants and tested it against existing synthetic pheromones.

According to PhysOrg:

> [They] baited moth traps with the plant-produced pheromone. They found that each trap attracted an average of 130 male moths—half the number of catches possible with synthetic pheromones but enough to demonstrate the effectiveness of the biosynthetic method.

Löfstedt told ScienceNOW that the goal is to bypass the extraction step entirely, and create plants that can effectively release the pheromone themselves.

If Löfstedt and his team are successful in this next step, it could mean the development of plants whose only purpose is to serve as living traps meant to confound pest insects. Rather than deploying pesticides or even setting up manually maintained synthetic pheromone traps, farmers could plant a few genetically engineered tobacco plants among their crop that would essentially scramble pest insect communication over a wide area and prevent them from successfully breeding in their crop.

Genetic modification as a tool to fight pests often is often portrayed as strictly destructive. It's dominated by the success of plants which produce their own pesticides (e.g., the Bt series of crops) and crops which have been engineered to survive the application of herbicides (e.g. Roundup Ready crops). Recent efforts like the push into species-specific RNAi pesticides are certainly likely to produce even less collateral

damage. In contrast, Lofstedt's work combines genetic modification and the ideas driving the biopharming revolution to remind us that there are more subtle methods of pest control than outright killing.

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Additional Resources:

- Emerging tools for synthetic biology in plants, Plant Journal