

Corn seed treatment insecticides pose risks to honey bees, yield benefits elusive

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Nearly every foraging honey bee in the state of Indiana will encounter neonicotinoids during corn planting season, and the common seed treatments produced no improvement in crop yield, according to a Purdue University study.

Neonicotinoids, including clothianidin and thiamethoxam, are a class of insecticide commonly applied as a coating to corn and [soybean seeds](#) to protect them from early-season pests. Since the coatings are sticky, a talc or graphite powder is added to vacuum systems in planters to keep the seeds from clumping. Powder exhausted from the planter contains neonicotinoids.

The United States is losing about one-third of its honeybee hives each year, a significant problem since the [bees](#) pollinate many crops used to feed people and livestock. Neonicotinoids, which are highly toxic to honeybees, are being scrutinized as a possible contributor to the losses.

Christian Krupke, a professor of entomology, showed in 2012 that exhausted insecticides collected on flowers that border agricultural fields and were present in hives near those fields. Bees in those hives showed physical signs of insecticide poisoning, and dead bees tested positive for the neonicotinoids used as [seed](#) treatments of corn and soybeans.

Now, Krupke, along with collaborators Jeff Holland at Purdue, Elizabeth Long at Ohio State University, and Brian Eitzer with the Connecticut Agricultural Experiment Station, have measured the drift of those

neonicotinoids from fields and found that the insecticides can settle on flowers up to 100 meters from the edge of the planted fields, the farthest distance examined in the study. Their findings are published in the *Journal of Applied Ecology*.

Mapping Indiana's [corn acreage](#), as well as the areas that may receive drift, the authors say that 42 percent of the state is exposed to neonicotinoids during crop planting. Looking at public data on the location of apiaries and projecting the range that honey bees forage, they found that 94 percent of bees could fly through areas that contain lethal doses of the insecticides during the period when corn is planted.

"Our previous study showed that these neonicotinoids are likely to leave the field, but we wanted to demystify that distance and show how far the material moves, at what concentrations and what the actual risk is," Krupke said. "There was a misconception that any bees not living near corn were likely to be fine. But that's not true, and it's clear that these insecticides are reaching into the places bees forage and putting them at risk."

Krupke's team set up dust collection stations at 12 Indiana fields where corn was being planted and collected samples for two years at distances up to 100 meters. Analysis of the collected dust showed lethal doses of neonicotinoids were reaching the farthest traps. Added to the clouds over the fields during planting, Krupke said bees are exposed to significant risk.

"As planter exhaust is blown up and away from the equipment, it gets into the air stream and is at the mercy of whatever is going on with the wind," Krupke said. "It's not all that different from the pesticide drift that we've talked about for years, but these products were supposed to solve that problem. Now we know that they also drift."

In the same study, the researchers found no evidence that neonicotinoids increased yield in corn. The authors tested untreated corn seed, and seeds coated with neonicotinoids and fungicides at both high and low doses, at three locations around Indiana. There were differences in pest damage at one site, but those did not translate into yield loss.

The authors conclude that the lack of benefit for corn yields in their study, as well as inconsistent findings in U.S. corn, soybean and oilseed rape in Europe, "suggest that the current use levels of insecticidal seed treatments in North American row crops are likely to far exceed the demonstrable need, and our results likely reflect a scarcity of target pests."

The industry continues to work on alternative seed lubricants to reduce dust movement at planting, but to date progress has been limited. According to a Penn State study analyzing USDA pesticide use data, the rates of neonicotinoid use in corn have doubled since 2012.

Finally, the authors say that the risk to bees and other non-target organisms could be more significant than their paper suggests. They only examined cornfields in this study, and soybeans are also typically treated with neonicotinoids. The study transects were limited to 100 meters from field edges, but it's possible that lethal doses reach further. And they did not account for the fact that bees create static charges on their bodies during flight, which means they may be attracting insecticide-tainted dust during flight and not just when landing on flowers.

Neonicotinoids are on almost all [corn](#) and most soybean seeds sold in the U.S., though Krupke said that this study and other reports of inconsistent yield benefits, show that widespread use is unnecessary and farmers could benefit from access to seeds not treated with insecticide. He will focus research on determining the circumstances in which neonicotinoids are useful for improving yield, and he will encourage

farmer access to [neonicotinoid](#)-free seed, which is almost non-existent in the current market.

"The good news is that because farmers often don't need these additions to seeds or benefit from them, we can easily and rapidly reduce the risk simply by having untreated seeds available," Krupke said. "That would also allow farmers to make some side-by-side comparisons in their own fields."

More information: Planting of neonicotinoid-treated maize poses risks for honey bees and other non-target organisms over a wide area without consistent crop yield benefit. [DOI: 10.1111/1365-2664.12924](https://doi.org/10.1111/1365-2664.12924)

Provided by Purdue University

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