

# Study identifies ways to encourage 'refuge' planting, slowing resistance to Bt crops

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Credit: Alexander Steinhof

A new study from North Carolina State University finds a significant shortfall in the amount of "refuge" cropland being planted in North Carolina – likely increasing the rate at which crop pests will evolve the ability to safely devour genetically engineered Bt crops. However, the

study also identified actions that may make farmers more likely to plant refuge crops in the future.

For about 20 years, [growers](#) have made use of Bt [crops](#) to limit crop damage from pests. Bt crops, including corn, are genetically engineered to produce proteins from the *Bacillus thuringiensis* (Bt) bacterium. These proteins are harmless to vertebrates, but toxic to a specific class of invertebrate crop pests.

To date, these Bt crops have been remarkably successful. However, insect pests have shown the ability to evolve resistance to Bt proteins. In order to slow down the development of Bt resistance, farmers who plant Bt crops are urged to plant a certain percentage of their fields with non-Bt crops – called refuge crops. In fact, in the case of Bt corn, farmers are required to plant a section of their fields with refuge crops.

That's because refuge crops provide fodder for insect pests that are not resistant to Bt proteins. These pests are then able to breed with their Bt-resistant counterparts, diluting Bt resistance in the overall [pest](#) population.

But compliance with planting refuge crops is variable. Some growers plant too little of their fields with Bt crops, and some don't plant refuge crops at all.

This raised some interesting questions for Dominic Reising, an associate professor of entomology at NC State and an extension specialist at the Vernon James Research & Extension Center in eastern North Carolina. Reising divides his time between conducting research and helping farmers deal with problems related to insect [crop pests](#). Recently, Reising began to wonder: How many growers aren't planting sufficient refuge crops? Do growers understand the rationale behind refuge crops? What can influence whether growers plant refuge crops? And what factors affect a

grower's willingness to plant refuge crops?

To address these questions, Reisig talked with several hundred corn growers in more than a dozen counties in eastern North Carolina.

Reisig found that approximately 40 percent of corn growers who used Bt corn would not plant refuge crops in the next growing season, while another 25 percent weren't sure. However, a majority of growers did understand the value of refuge crops – and felt they should be planting them.

Reisig also found that there was a high correlation between how much land was devoted to corn, cotton and soybeans in a county, and how likely farmers in that county were to plant refuge crops. The more land being devoted to crops, the more likely farmers were to plant refuge.

"Some of the resistance to planting refuge may be due to a lack of understanding about how important refuge crops are," Reisig says. "But it's also likely to be a function of the fact that many of the farms in counties with low refuge crop compliance are smaller operations. Growers may simply be trying to get more crop yield from their acreage – though there is little evidence of short-term benefit, and ample evidence of long-term risk from Bt-resistant pests."

Reisig also found that better enforcement and peer pressure from other farmers weren't seen as making farmers more likely to plant refuge crops. Instead, growers said that financial incentives – such as rebates on non-Bt seed – would make them more likely to plant [refuge](#) crops, as would the availability of high-yield non-Bt seed.

"This study is really a starting point," Reisig says. "We know this is a problem. I'm looking for partners in the social sciences to help me figure out how we can help growers make informed decisions and protect the

long-term viability of their crops."

**More information:** Dominic D. Reisig. Factors Associated With Willingness to Plant Non-Bt Maize Refuge and Suggestions for Increasing Refuge Compliance, *Journal of Integrated Pest Management* (2017). [DOI: 10.1093/jipm/pmx002](https://doi.org/10.1093/jipm/pmx002)

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