Unintended Effects of Genetic Manipulation
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GMO Semi-Dwarf Poplar Trees May Be More Susceptible to Pests

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Researchers studying hybrid poplar trees that were genetically engineered to grow only to semi-dwarf size expected to find higher levels of certain chemicals in the poplars' leaves that are related to greater pest resistance, compared to their levels in a non-GMO hybrid poplar. But instead, in one of the four GMO lines analyzed in the study they found a lower level, compared to the non-GMO control, of one such chemical. And in a second GMO line they found a lower level of two such chemicals, compared to the control. In these two lines they also found higher levels of nitrogen in the leaves, which could benefit insect development.

The differences between the GMO and non-GMO trees were "moderate," but the combination of these effects may make the trees more susceptible to pests, the authors of the peer-reviewed study concluded. It was published in the *Journal of Plant Ecology* in January 2018.

The other two GMO experimental lines did not show the growth pattern of shorter stem height, characteristic of semi-dwarf trees, despite the engineering attempt to induce that trait. All four of the experimental groups of trees were the result of various gene insertions to lessen the action of gibberellins. Those are naturally occurring plant hormones that influence many aspects of plant growth and development, including seed germination, cell elongation and division, shoot growth, leaf expansion, flower induction, and fruit development.

The authors, from the University of Wisconsin and Oregon State University, cite earlier research in noting that plant defenses against herbivores "may be influenced, sometimes unintentionally, by genetic engineering (GE)," and that plant defensive traits can greatly influence the interactions between plants and the vertebrates or insects that feed on them. In this case, which involved a field trial of poplars grown outdoors in pots, the researchers had hypothesized that the semi-dwarf trees would be able to convert more carbon to the production of chemical defenses against pests, since they would use less of it to generate overall biomass.

Instead, in two different GMO lines, compared to a non-GMO control, they found the results described above. In discussing their measures of nitrogen, they noted that the level of nitrogen is also a kind of chemical resistance trait, since it can affect both the preference of insects for particular plants and the rate of insect growth, survival, and reproduction. (Many insects seek food sources that are high in nitrogen.)

The study concluded that the genetic modifications to gibberellin activity had had moderate effects on resistance traits, but that even moderate changes "may be biologically significant for herbivores that are sensitive to specific defence chemicals." It also called for larger, longer-term studies "to fully understand GE consequences for growth and herbivore defence."

The authors concluded that "some of the modifications we observed do have the potential to alter non-target resistance traits over time, and warrant further research, especially under plantation conditions." The results from this short-term study suggest, they added, "that genetic modification of growth traits in *Populus* has some non-target effects on chemical resistance traits." Poplars (genus *Populus*) are considered a good model for testing effects on

woody plants in genomic and biotechnology research.

“Although the effects of down-regulated GA [gibberellin activity] levels on defence against herbivores appear moderate,” the authors added, “they highlight the potential for unanticipated side-effects when modifying even a single gene. Impacts such as increases in specific defence traits can make a particular modified genotype more or less susceptible to generalist versus specialist pests.”

Sources

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