Experimental Systems to Monitor the Impact of Transgenic Corn on Keystone Soil Microorganisms

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Abstract

After the approval of the European Community Directive 2001/18 a debate began in Europe about the coexistence of genetically modified organisms (GMO) and organic or conventional agriculture. Risks and benefits of transgenic crop plants should be evaluated in space and time, that is, not only by assessing pollen flow, but also by considering soil persistence of transgenic products, such as Bt toxins, which can accumulate in the soil after absorption to clays or binding to humic acids, remaining active for a long time. Moreover, transgenic plants are often plowed under as crop residues, representing a potential hazard for nontarget soil microorganisms, such as arbuscular mycorrhizal (AM) fungi. These keystone soil organisms are a group of beneficial plant symbionts fundamental for sustainable and organic agriculture, given their important role in soil fertility, plant nutrition, and ecosystem functioning. In this study, we monitored the effects of transgenic corn plants (Bt 11 and Bt 176) and their residues on AM fungal growth and root colonization ability in greenhouse experiments. Both transgenic plants showed decreased mycorrhizal colonization after eight to ten weeks of culture. Mycelial length of G. mosseae grown in soil containing Bt and non-Bt corn residues was monitored for up to four months and did not show significant differences among lines. On the contrary, both Bt corn residues negatively affected mycorrhizal establishment by indigenous endophytes. Mycorrhizal colonization was particularly reduced in Bt 11-amended soil, four months after residues being plowed under. Further long-term studies in the field are necessary to evaluate the interactions of GM plants with microbial communities fundamental for soil fertility and quality. In particular, the risk posed by GM plant residues to nontarget beneficial soil microbes should be thoroughly investigated, since any reduction in their biodiversity might produce long-term effects on crops sequentially cultivated in the same soil in years to come.

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