

5.3 Using diversity to decrease the risks of plant-incorporated pesticides to pollinators

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Abstract

Plant-incorporated pesticides (PIPs) are a widely adopted strategy for insect pest control in many of the major crops worldwide. They include the neonicotinoids, Cry toxins of *Bacillus thuringiensis* (Bt), and RNAi crops. While the systemic nature of PIPs reduces the need for foliar insecticide sprays, the expression of the active ingredient in floral tissues and guttation fluids of crops poses a potential route of exposure for beneficial insects, including pollinators. The adoption of PIPs in crops is widespread, particularly in corn and soybean crops of the Upper Great Plains, which is also the summering region for the majority of honeybees in the United States. The landscape is highly homogenized in this region with the majority of land devoted to production of corn and soybeans, and an accompanying loss in flowering marginal vegetation. This leads to decreased diversity of local native pollinators and a selection for a few dominant agrobiont species. Decreased access to diverse floral resources also leads to decreased pollinator health and the risk of compounded adverse effects when simultaneously exposed to other environmental stressors, such as PIPs, particularly as honeybees will use corn pollen and guttation fluid as important pollen and water resources, respectively, when they are available.

Incorporating more optimal foraging habitat within the landscape as conservation strips that include high floral diversity with blooms throughout the growing season will be crucial to boosting pollinator health. These may serve as a buffer to pollinators by encouraging foraging away from treated croplands when crops are flowering, thereby limiting exposure and mitigating the risks posed by PIPs.