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Applying Pesticides to Crops More Dangerous than Pesticide Producing Crops

Pesticides are a common tactic used to preserve crop health and increase crop yield. However, pesticide sprays are often harmful to the environment. Relatively recently, a method of genetic modification was created such that the crops would be able to produce these pesticides themselves, rather than be sprayed with the pesticides. Genetically modified plants should be used over pesticide sprays as genetically modified plants are safer for the environment than pesticide sprays.

Pesticide sprays are harmful to the environment. Pesticide sprays are designed to kill pests in agricultural fields, but are rarely confined to the field. They fairly often run off of the field and into rivers; pesticides are detectable in around 60 percent of wells and around 10 percent have detectable levels of at least five different types of pesticides (Environmental Protection Agency). And since the pesticides are in the water, it is possible that the pesticides can affect creatures in the water. And there is the land between the fields and the water – basically even though most pesticides cannot affect many types of creatures, they can harm creatures in a wide range of areas. This makes such sprays harmful to the environment and a more general biodiversity.

Insecticides are intended to kill insects that would otherwise eat crops and make them unusable for human consumption. They are rarely dangerous to humans, but can be dangerous to the greater wild when not contained properly, destroying much more than just the insects in the area near the crops. When applied externally to plants, insecticides can very easily run off with rainwater into rivers or streams. Genetic modification allows plants to create the insecticides, effectively acting as if the insecticide was applied inside the plant instead of outside (Ramanujan). Pollen is one of the few ways that a toxin is leaked out of a plant and onto nontarget species. The insecticide is still as effective at destroying those insects that would attack or eat the plant, but the plant is able to contain the insecticide, preventing it from destroying a lot of unintended wildlife.

One of the common insecticides are proteins produced by *Bacillus thuringiensis*, hence they are referred to as Bt toxins. It has been used since 1920 in spray form to kill of harmful pests in crops, and in 1995 was one of the first types of insecticide that crops have been genetically modified to produce (Lemaux). Overall, it is effective at killing insects that harm the crops. However, just putting the pesticide everywhere tends to cause any insects that remain to be immune to the pesticide, requiring more drastic and overall destructive measures. Fortunately, a method does exist and is widely deployed to limit the selective pressures for toxin immunity: refuging (Lemaux). This leaves patches of throwaway plants unprotected, as a refuge for unimmunized pests so that the pests as a whole will be less immune to the toxin (Lemaux). Refuging is much less maintenance-intensive when done by genetic modification, making it harder to mess up, and more likely to allow toxins to remain effective longer.

Of course, target creatures are not the only ones affected by such toxins. Spiders are not an intended target of insecticides: carnivorous spiders tend to eat bugs that are the target of insecticides and even herbivorous spiders tend to not harm crops. Spiders are not directly poisoned by Bt toxins through known pathways. However, they still tend to contain the toxins when they are in fields that are either sprayed with Bt toxins or contain Bt crops. (Peterson, Lundgren and Harwood). However, tests showed that spider populations were larger in fields with Bt crops than in fields treated with Bt and the difference between spider populations in fields with Bt crops and in fields with untreated crops was insignificant (Peterson, Lundgren and Harwood). Bt-producing crops are better for spider population health than crops sprayed with Bt.

Other predators are mostly unaffected by Bt crops as well. For example, the studies involving green lacewing showed that it was not insecticides themselves, but reduced quality of prey due to insecticides that may affect the green lacewing (Sanvido, Romeis and Bigler). However, the Bt-affected pests in the experiment, lepidopteran larvae, are not the only prey used by the green lacewing; the results of the experiment are considered less important than what should happen in the field (Sanvido, Romeis and Bigler). The same is true of many other arthropod predators - they can change food source easily when one food source is rare. Again, broad-spectrum insecticide sprays are less targeted than Bt, and have been consistently shown to affect predator species more than Bt (Sanvido, Romeis and Bigler); the broad-spectrum sprays affect more types of prey which gives predators even less food to choose from. In this way, Bt crops have less effect on non-target predators than other sprays.

Monarch butterflies are another nontarget species that is affected by Bt toxins. A type of Bt toxin can kill monarch butterflies. Several tests performed showed that a few types of Bt Corn pollen could adversely affect butterflies in the same way, but only within in a range of 12 feet (Lemaux). In addition, the specific type of Bt toxin that affects monarch butterflies, event 176, has been pulled from the market of Bt crops (Sanvido, Romeis and Bigler). It is significantly easier to not insert a gene into a plant than to remove a chemical from the bunch of toxins made by a bacterium. Therefore, since the type of toxin that affects monarchs can be not added to plants easier than removed from the bacterium, the Bt crops are safer for monarch butterflies than Bt sprays.

Herbicides are another type of pesticide, which tend to kill plants. The main application of herbicide in relation to genetic engineering is herbicide tolerance, as in making the plant immune to a certain herbicide, so a herbicide kills weeds and not the crop. Unintuitively, perhaps, herbicide-tolerant crops tend to have less herbicide applied to them than herbicide-vulnerable crops, decreased by around 25% (Lemaux). The herbicide resistance changes the herbicides that can be used without harming the crop.

This can result in more targeted herbicides which can more greatly affect target species and be less toxic to the overall environment (Morris). An example of this is red rice. It is a weed that appears commonly in domestic rice fields. As red rice is the same species as domestic rice, most herbicides that would affect red rice also affect domestic rice (Lemaux). The traditional solution is application of a generalized herbicide which domestic rice just coincidentally evolved to be resistant to. There is a different herbicide which affects only the rice plants. However, since rice crops are as susceptible to the herbicide as the red rice, without the modification to make the crops resistant to the herbicide.

Another example is the relatively recent creation of glycophosate-tolerant wheat. Many of the herbicides heavily used now, including dicamba, fenoxaprop, triallate and bromoxynil, are more toxic, even to humans, than glycophosate (Peterson and Shama). Glycophosate also does not affect seed emergence (Peterson and Shama), although this does mean some nutrients may be used by weeds on the farm that otherwise might not be, it does reduce the harm to seedlings off the farm. And glycophosate has a lower ability to harm aquatic plants than other herbicides. (Peterson and Shama). Making wheat resistant to glycophosate means that glycophosate can be used instead of one of the more harmful herbicides. Since glycophosate is less harmful than other herbicides, it is preferable to use it over other herbicides, which can only be done if wheat is genetically modified to resist it.

Genetic modification of crops can reduce the effect of pesticides on the environment. When plants are genetically modified to produce insecticides, it affects nontarget species less than when plants are sprayed with insecticides. When plants can be resistant to herbicides, those herbicides can be used to protect the plant and those herbicides can be more targeted than other herbicides. Genetic modification of crops is beneficial to the environment.

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