Friends of the Earth

Gene-Silencing Pesticides

Risks and Concerns

Pesticide companies, including Bayer, BASF, and Syngenta, are using genetic engineering to develop an entirely new type of pesticide. These pesticides would kill pests by switching off or "silencing" genes essential for survival in insects.

This is significantly different from genetically engineering crops. Rather than creating a genetically modified organism (GMO) in the lab, gene-silencing pesticides will be applied to crops in the open environment. Insects or other organisms that come into contact with the pesticide or consume contaminated leaves may be genetically modified, and these modifications may be passed on to multiple generations.

This technology is virtually unregulated, both domestically and internationally, and therefore is on track to be commercialized without proper risk assessments or precautions. This constitutes a vast open-air genetic experiment that raises concerns for the environment and public health.

HOW IT WORKS

Gene-silencing pesticides exploit a cellular process called RNA interference (RNAi) which occurs in plants, fungi, and animals including insects. The RNAi pathway functions to control whether a gene is turned off or not. Genetic engineers activate this process using synthetic RNAi molecules produced in laboratories.

For example, RNAi could be applied as a foliar spray on leaves. After the pest eats the leaves, interfering RNA enters the insect's stomach and silences a gene that is essential for cell division, following which, the pest cannot make functioning new cells, and dies.

RISKS AND CONCERNS

The limitations of our knowledge and ability to predict or control the outcomes of this novel genetic engineering application are profound.

Environmental concerns: Genetically modifying organisms in the open environment makes controlling exposure difficult to impossible. RNAi technologies are widely associated with off-target activity — the silencing of genes that weren't intended to be silenced — both within the genome of target organisms as well as non-target species. Research demonstrates RNAi pesticides' potential to harm beneficial insects including honeybees and beetles. And there is evidence suggesting that targeted pests will rapidly develop resistance to RNAi pesticides, reinforcing the "pesticide treadmill" characteristic of industrial agriculture.

Human health concerns: Farmers, farmworkers, and rural communities may be exposed to synthetic interfering RNAs via spray drift; the risks pertaining to inhalation exposure are completely unknown. Unwanted gene silencing could potentially alter levels of toxins or allergens in crops. Preliminary research suggests that synthetic RNAi in our diets could have the potential to interfere with physiological processes in our bodies with unforeseen health implications. Medical research suggests the potential for toxicity, finding that therapeutic uses of interfering RNAs can cause an potentially harmful inflammatory response in the body.

Socioeconomic concerns: Biotech and pesticide corporations are filing patents for RNAi pesticide products that include claims of property rights to exposed organisms and their offspring. This would constitute a massive expansion of property rights over nature, ever more deeply entrenching the power of biotech companies over the food system, farmers, and the natural world itself.

Knowledge gaps: Many significant knowledge gaps — from the genome to organism to ecosystem level — limit our ability to responsibly assess the potential impacts of RNAi pesticides. RNAi pathways are not currently fully understood and are more complex than the simplistic, linear theory exploited by developers. It is not currently possible to predict off-target effects within organisms' genomes, and we currently lack the ability to answer fundamental questions about which non-target species could be exposed. Research conducted to date on RNAi mechanisms has primarily been in model organisms, not in the diversity of species that exist in the wild, seriously limiting our understanding of how certain species may respond to being exposed to RNAi pesticides.

INDUSTRY MYTHS

The biotech and pesticide corporations developing gene-silencing products are creating false distinctions between RNAi and other genetic engineering technologies and are downplaying potential risks in order to avoid regulation and achieve rapid commercialization of RNAi products.

- Effects of RNAi pesticides are not "transient" — Research demonstrates that RNAi pesticides can result in heritable modifications that last up to 80 generations, and industry patent applications for RNAi products have claimed heritability.
- RNAi pesticides are not "natural" — RNAi pesticide formulations are based on synthetically derived interfering RNA molecules, and developers may add chemicals, nanoparticles or other synthetic materials to RNAi pesticide formulations.
- RNAi pesticides are not "precise" — Research suggests a host of potential unintended effects from the genome to organism to ecosystem level.

REGULATION

RNAi pesticides currently fall outside of existing domestic and international regulatory structures and therefore have yet to be regulated in most parts of the world. In the U.S. and EU, it is expected that RNAi pesticides will be regulated under existing pesticide regulations. Such regulations are inadequate to address the novel biosafety and environmental challenges raised by this technology.

RNAi pesticides should be regulated as a form of genetic engineering, using process-based and precautionary assessments and oversight. RNAi processes can result in genetic changes in exposed organisms as well as altered traits that can be passed down to offspring. This has been raised by U.N. delegates at the United Nations Convention on Biological Diversity.

CONCLUSION

Given the enormous potential risks and major gaps in knowledge about RNAi pesticides, it is imperative that civil society, farmers, and concerned scientists push for strong regulations and proper risk assessments before this technology is commercialized.

Gene-silencing RNAi pesticides represent both an extension of an old, failed paradigm of pesticide-intensive agriculture, as well as a completely novel set of potential harms. Rather than continue on a pesticide treadmill in which farmers use new formulations of toxic pesticides to deal with resistant pests, ecological farming methods offer a true solution that protects the biodiversity, soil, water and climate that we need to grow food. Over the past decade, a series of expert consensus reports have called for a rapid shift from input-intensive industrial agriculture to agroecological farming methods. Business as usual is not an option. Our ability to continue to feed ourselves and future generations is at stake.

For more information and to view our report, *Gene Silencing Pesticides: Risks and Concerns*:
foe.org/RNAI-report