

Gene Flow to Wild Plant Relatives

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Gene Flow to Wild Plant Relatives

Gene flow via pollination is a natural process whereby genes, aided by wind or insects, are exchanged between plants. This process can occur between sexually compatible plants and wild relatives if the appropriate conditions are met. In the case of crop plants, this process can occur regardless of whether the crop plant was developed through conventional plant breeding or biotechnology. Developers of biotechnology-derived crop plants carefully consider the potential for gene flow to other crop plants and wild relatives.

Crops derived through biotechnology undergo a rigorous risk assessment process to evaluate this potential. Nevertheless, some people have expressed concern that genes added to crops through biotechnology, such as insect resistance or herbicide tolerance, might spread to wild or weedy relatives creating a “super weed” that is either difficult to control or detrimental to the environment.

CONDITIONS FOR GENE FLOW

While there is no question that the natural process of gene flow via pollination does occur, there are a number of conditions that must be met for gene flow to have an impact on a wild population (Doebley, 1990).

First, there must be sexual compatibility between the plants in question. If there is no sexual compatibility between plants, there can be no gene flow — just as a bird cannot successfully mate with a frog. The pollinating characteristics of the particular plant species are important as well. Some crops, such as corn, are cross-pollinators and can exchange genes relatively easily with other corn plants or with wild relatives under appropriate conditions. Gene flow in self-pollinators, such as wheat and soybeans, occurs infrequently. In addition, the crop must be grown in an area where a wild relative is native. There are no wild relatives of corn or soybean, two of the most widely planted crops in the U.S., so gene flow from these crops into wild populations is zero (Rissler and Mellon, 1993).

Second, there must be a benefit associated with the gene of interest in order for it to persist. Genetic modifications must increase a plant’s ability to survive and reproduce in order for any gene to be actively selected and preserved over generations. There is little selective advantage to having a trait that confers herbicide-tolerance in a wild relative of corn if that herbicide is not present in the natural environment of that wild relative. Cultivated crops are highly domesticated and generally are unable to survive in the environment without human assistance.

REGULATORY REVIEW

In some cases — such as with sorghum and sunflowers in the U.S. — there is a greater likelihood for cross-pollination with weedy relatives because these exist where sorghum and sunflower are grown. So should a sorghum or sunflower plant derived through biotechnology be considered for commercialization in the future, the regulatory review process would require consideration of the potential impact on weediness of wild or weedy relatives. The potential for gene flow between weedy species and a related crop derived through biotechnology is a key component of the risk assessment required by regulatory agencies for every new plant variety developed through biotechnology.

In conclusion, each crop species derived through biotechnology is thoroughly evaluated for the likelihood and consequence of gene flow. In the United States and Canada, crops such as corn and soybeans do not have wild relatives nearby, so gene flow is limited to neighboring cultivated plants within the same field or to nearby fields. The likelihood of gene flow diminishes the farther apart plants are located, even if they are in the same field or region. For some crops such as soybeans, pollination characteristics limit gene exchange even between neighboring plants in the same field. For still others such as sorghum and sunflowers, more attention must be given to cross-pollination with weedy relatives.

As gene flow is a natural process, it is important to improve our understanding of this phenomenon, and modern biotechnology is helping make research into gene flow more accurate and informative.

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