Keeping Transgenic Pollen in Its Place

How far can bees carry pollen? At least two-thirds of a mile, according to ARS plant geneticist Daniel Z. Skinner in Pullman, Washington. Why is that important? Because pollen acts as a vehicle to transport genetic material throughout a plant population or into a related species.

"In 2004, we can expect to see the first transgenic alfalfa variety on the market, and others are expected in following years," says Skinner. "We need this kind of information so that problems don't arise from the accidental dispersion of transgenic alfalfa pollen to wild populations of alfalfa."

Skinner and Kansas State University alfalfa breeder Paul St. Amand conducted a 3-year biorisk assessment study. This type of information has never been obtained for alfalfa. The study was conducted in Manhattan, Kansas, and in Prosser, Washington, near the ARS Irrigated Agriculture Research and Extension Center.

Alfalfa, *Medicago sativa*, has no other close weedy relatives. It relies on honey bees and leafcutter bees for pollination. The amount of potential pollen flow between adjacent alfalfa seed-production fields is a key factor in setting isolation requirements.

In production fields, Skinner and St. Amand planted alfalfa that carried a rare but naturally occurring molecular marker, which allowed the pollen to be tracked as if it contained a new gene. They tracked pollen movement from the marker-bearing alfalfa plants to trap plots planted up to 3,280 feet (1,000 meters) away. Also, they found volunteer alfalfa plants along roadsides and measured the distance between them and the production fields with an optical rangefinder or an automobile odometer. Seeds from volunteer plants and the trap plots were collected and were sprouted, and the sprouts were tested for the molecular marker. If the marker was found, that seed must have originated from pollen carried by bees from the production fields.

Leafcutter bees, used in commercial seed production, flew from their hives for a distance of two-thirds of a mile and back home. According to St. Amand, the bees would likely have moved pollen even greater distances, but the test ended at 3,280 feet. He and Skinner used statistical models to estimate that a minimum isolation distance of 5,109 feet from the hive to any other alfalfa field may be required to prevent gene flow.

The researchers recommend that producers consider changing their seed-production practices. They suggest placing bee colonies in the center of the alfalfa field instead of along the side and surrounding the field with flowering crops like birdsfoot trefoil or sainfoin so that bees would become covered with other pollen and no longer transmit alfalfa pollen if they leave the field. These practices are expected to limit pollen dispersal, but Skinner cautions that more testing will have to be done.

The ARS study was conducted independently, with partial support from the Cooperative State Research, Education, and Extension Service and ARS' Biotech Risk Assessment Program. It preceded a study done by Forage Genetics International, Madison, Wisconsin, and the North American Alfalfa Improvement Conference.—By **Linda McGraw,** ARS.

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Daniel Z. Skinner is in the USDA-ARS Wheat Genetics, Quality, Physiology, and Disease Research Unit, Washington State University, 209 Johnson Hall, Pullman, WA 99164; phone (509) 335-8696, fax (509) 335-2553, e-mail dzs@wsu.edu.

Paul St. Amand is in the Agronomy Department, Kansas State University, 4008 Throckmorton Hall, Manhattan, KS 66506; phone (785) 532-7746, fax (785) 532-6094, e-mail pst@ksu.edu. ◆