Experimental Soybeans Sabotage Roundworm Pest With Its Own Gene

BELTSVILLE, MD.

Using biotechnology, Agricultural Research Service (ARS) scientists have fortified the defenses of soybean plants against tiny but destructive pests called soybean cyst nematodes (SCN).

The wormlike pests live in the soil, where they can wriggle into soybean roots to feed, mate and lay eggs. The damage they cause to root cells obstructs the flow of nutrients and water to the rest of the plant, weakening it.

Such attacks cost U.S. soybean farmers up to $1 billion in losses annually. Although SCN-resistant soy varieties are available, the nematodes can eventually overcome the resistance by evolving into virulent new races. Fumigating soils before planting can diminish the pest's numbers, but such chemical control is costly.

As an alternative, ARS plant physiologist Ben Matthews and colleagues in Beltsville, Md., are exploring the use of genetic engineering to bolster SCN resistance in soybeans using novel or existing genes.

Earlier this year, for example, Matthews' team completed greenhouse trials of soybean plants whose roots had been engineered with a DNA copy of one of the nematode's own protein-making genes. When nematodes ingest the DNA copy, the DNA "deactivates" the expression of the pest's corresponding gene, so it stops making the protein.

Soybean cyst nematodes

Photo courtesy of Ben Matthews, ARS.

In greenhouse trials at the ARS Soybean Genomics and Improvement Laboratory in Beltsville, 80 to 90 percent of juvenile female nematodes that fed on the engineered soybean roots died or failed to mature by 30 days.

Matthews' team, together with a Towson University bioinformatics expert, used comparative genomics and genome sequence information from another nematode species, Caenorhabditis elegans, to identify the SCN protein gene they targeted.

According to Matthews, a second round of greenhouse studies is planned to confirm the initial results. Similar studies with other resistance-conferring genes are under way.

Commercial soybeans derived from the team's research are at least eight years away. That's contingent upon successful field tests, further refinement, regulatory approval, propagation and other requirements, notes Matthews. Δ