New Root Rot-Resistant Soybean Gene Discovered

WOOSTER, Ohio — A new soybean gene, showing resistance to Phytophthora root rot, has been identified — the first time in nearly 20 years a gene exhibiting effectiveness against the disease has been discovered.

Ohio State University plant pathologists and soybean breeders, who made the discovery, have named the new gene Rps8. The germplasm containing the gene will be licensed for breeding purposes.

Anne Dorrance, an Ohio State plant pathologist with the Ohio Agricultural Research and Development Center, said the discovery is a "major find" in the war against Phytophthora root rot. She emphasized, however, that at least another year of work needs to be completed before it can be determined just how effective the new gene is in protecting cultivars in the field.

"This is a big discovery over a just seven-year span of research," said Dorrance. Ohio State researchers have been screening soybean germplasm lines searching for that "diamond in the rough" since the mid-1990s.

"Preliminary research results indicate that the new gene is effective against Phytophthora isolates collected from 50 locations in Ohio," said Dorrance. "Only one isolate per field was tested, so there is still much more work that needs to be done to see if the gene is effective against the majority of pathogen populations in the field, of which there could be thousands."

Despite the work cut out for them, researchers are excited about the preliminary test results. Effectiveness against multiple isolates could breathe new life into the struggle to control Phytophthora that growers are slowly losing.

Previous Ohio State research has shown that Phytophthora populations in Ohio soybean fields are adapting to plants carrying root rot resistant genes, specifically Rps1a, Rps1b, Rps1c, Rps1k, Rps3a and Rps6. These single genes are available in commercial cultivars.

Researchers found in Phytophthora isolates collected from soybean production fields in Ohio, that 95 percent of the fields sampled killed plants containing Rps1a gene; 65 percent containing Rps1b; 73 percent containing Rps1c; 78 percent containing Rps1k; 51 percent containing Rps3a; and 52 percent containing Rps6.

"Phytophthora root rot is the single biggest threat to soybean production. Reduction in yield from the disease can range anywhere from five to 30 bushels per acre depending on the resistance package in the variety. If a million acres of soybeans were infected by this pathogen, that could mean a loss of $120 million for the farmer," said Dorrance. "If this new gene proves to be effective against a broad population, it could last anywhere from eight to 20 years. We are hoping to boost the effectiveness to last 25-30 years by combining this gene with Rps genes that have been used in the past, plus partial resistance."

Phytophthora sojae causes soybean root rot and is a major problem in Midwest states which have heavy clay soils, such as Ohio. Heavy rains saturate the soil producing areas of standing water, which provide the perfect environment for the pathogen to infect plant roots. The pathogen grows in the roots and into the plant stem, eventually killing the plant.

"Fungal root rots represent a primary production constraint for soybeans in Ohio. This discovery represents a major breakthrough in protecting soybeans against root rot," said Steve Slack, OARDC director. "I am pleased that the commitment to scientific excellence and leadership in soybean research at The Ohio State University has led to this critical find."

The new gene was found in a traditional South Korean soybean variety, after researchers evaluated over 1,000 soybean plant introductions found in other countries. The importance behind the discovery is not only of a gene that shows resistance to root rot, but using molecular techniques, the gene has been found on a completely new area of the soybean genome. The new position makes it easier for researchers to breed this new trait into new and existing cultivars, potentially speeding up the pace of its use.

"The resistance gene is located on a completely new position of the genome, which is exciting," said Kara Burnham, an OARDC post doctorate student working on the project. "Genes found on previously identified regions of the genome, known as loci, may or may not be new. This gene is not on the location of any of the known genes, so it must be a new gene."

Apart from identification of the new gene, there are seven known root rot resistant genes, labeled Rps1-7. If a gene is located on an existing genome position, Rps1, for example, then the gene is designated with a letter, such as Rps1a.

'The good thing about the new gene, Rps8, is that it probably hasn't been seen in U.S. germplasm lines before because of its new location," said Dorrance, "so there is a high probability that it'll be effective."

The next step for researchers, apart from evaluating the gene's effectiveness in the field, is to incorporate it into cultivars that are adapted to Ohio's soil conditions and field characteristics.

"When I was a graduate student, I thought it would be neat to discover a gene," said Ohio State soybean breeder Steve St. Martin. "To be a part of the team that actually discovered a new gene is a dream come true for me. That is one accomplishment I can now cross off my list."

St. Martin holds a partial OARDC research appointment. He and *OARDC soybean breeder Ron Fioritto will be breeding the new gene into new and existing soybean cultivars.*

'Our goal is to develop varieties before we see any major losses from Phytophthora adaptation to existing resistant varieties," said St. Martin.

In addition to the new gene, researchers found certain South Korean germplasm lines that exhibited partial resistance to Phytophthora root rot - a discovery they continue to investigate.

The research is supported by checkoff funds from the Ohio Soybean Council. Soybean germplasm was obtained from the U.S. Department of Agriculture Soybean Germplasm Collection in Urbana, Ill.

Forage Information On The World Wide Web

Many of the Penn State's forage fact sheet publications and connections to other forage related sites can now be accessed on the Web at www.forages.psu.edu. The PFGC also has its home page at this site. Take a look sometime.

The AFGC Website can be accessed through the PSU forage site or directly at www.afgc.org. The AFGC site provides information about the many AFGC activities as well as links to affiliate council Websites across North America.