Charcoal Rot

Efforts Underway To Find Cultivars Resistant To Charcoal Rot

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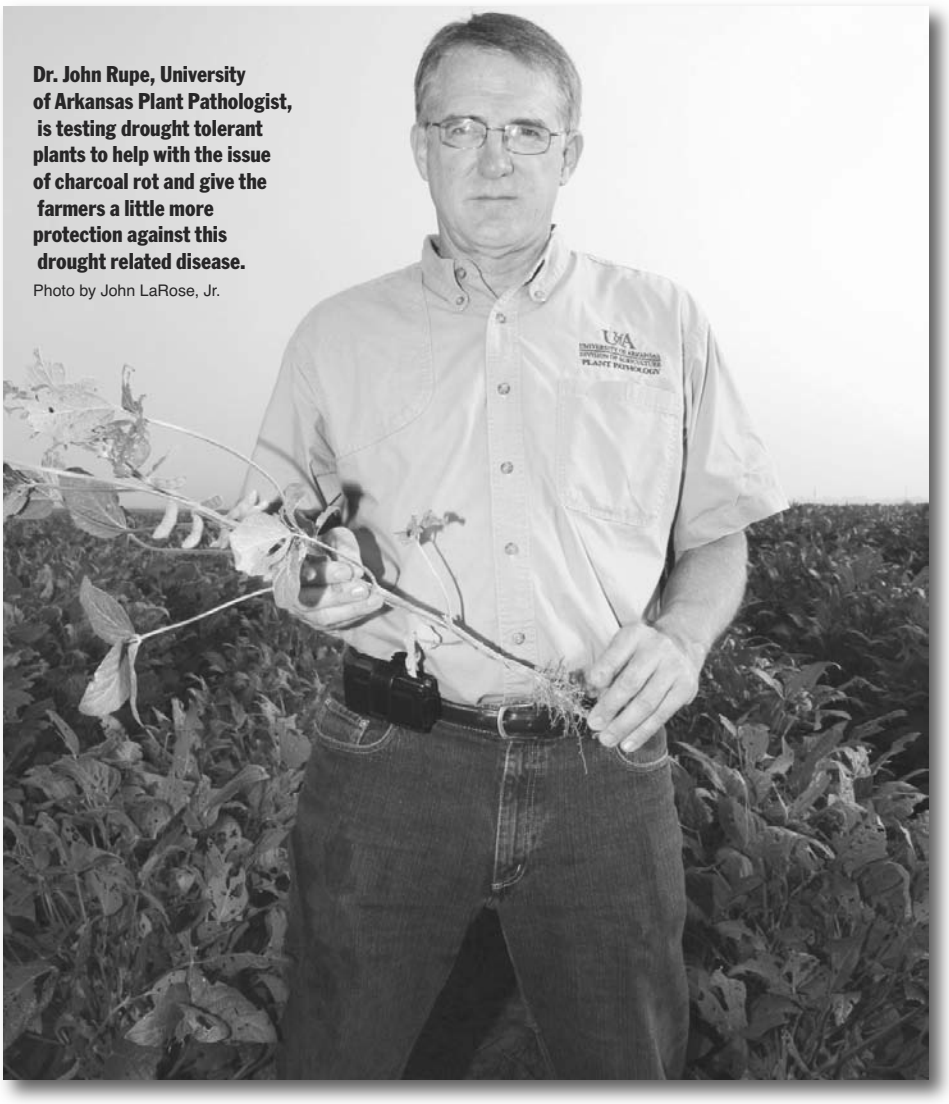
Charcoal rot was discussed by Dr. John Rupe, University of Arkansas plant pathologist, recently.

"We have a test on a field here where we are screening varieties to see if we can find those that are more tolerant to the disease," he said. "This is a drought related disease, and so, especially for our dryland farmers, if we can find something somewhat tolerant they can plant that and have a little more protection against this problem."



Dr. John Rupe, University of Arkansas Plant Pathologist, is testing drought tolerant plants to help with the issue of charcoal rot and give the farmers a little more protection against this drought related disease.
Photo by John LaRose, Jr.

While this is a difficult disease to work on, a few lines are showing some promise. Some of those will go into a regional test to be studied in four other states. Hopefully, that trial will bring some tolerant lines forward.

"The most obvious symptoms of the disease are plants that die," Rupe said. "It's more than just drought stress, plants look almost like they've been burned. They turn very dark and if you look at the roots you can find these microsclerotia which are bodies of the fungus that causes charcoal rot. They are black and can be found on the outside of the dead plants. If you split the stems you can see it colonizing the pith and the roots. It literally looks like charcoal and that's why they call it charcoal rot."

The fungus that causes charcoal rot, *Macrophomina phaseolina,* is a rather ubiquitous fungus that's found all over the world. It has an extremely wide host range, attacking about 500 species of plants. On soybeans, for a long time it was considered a problem just in the south, but that was probably because of weather conditions. It's hotter and drought is more frequent in the south, but charcoal rot has now been reported as far north as Minnesota so it's more of a weather phenomenon.

The disease usually hits after flowering because the plants are bigger, and at that time the plants' energy is going to seed fill rather than growth, so the root system is not as vigorous then. But depending on when it hits, the spots in the field that it attacks often have no yield at all.

"Now, like most diseases, especially soil borne diseases, the whole field usually is not affected," he said. "But you can have large parts of the field affected and in those areas the yield loss can be very severe."

There are elements of both an environmental problem and a genetic problem in this situation.

"Environment is definitely a part of this," Rupe explained. "The plants get drought stressed, even irrigated plants can be affected if you can't get the water on when you need to, or you have a breakdown in your irrigation system. I've seen irrigated fields where whole sections died out because they weren't irrigated for some reason. So there is definitely a strong environmental aspect as with most diseases. Then there is a genetic aspect which we are trying to understand in this test. We know that there are some lines that are less susceptible. Work out of Mississippi and Tennessee found breeding lines and plant introductions that seem to have a pretty good level of tolerance to this disease, so what we're trying to do is see if we can find commercial cultivars that have that. We are developing protocols for screening cultivars so that we can say something a little more definite about their reaction."

This is a disease that has been studied for many years and people have been trying to find solutions for many years, though not very successfully. Researchers are not making as much headway with this as they'd like. However, the regional project, funded by the United Soybean Board, is using regional testing of cultivars which promises to bear fruit. The regional trial uses a different technique of screening cultivars that is fairly unique and, hopefully, will lead to identifying lines that are resistant.

"In my test here I inoculate with the pathogen probably way more than needs to be," he explained. "In the regional test, we're inoculating a lot lighter, taking plants back, splitting them and then looking at colonization. I was trying to avoid that in this test because of the labor involved. However, I'm hoping with this new approach that we'll be able to say something a little more definite about cultivar reactions. By using a regional approach, if tests don't work in one area they'll probably work someplace else, so we're hoping by doing this we can generate information a lot quicker than with individual tests that are difficult to compare. Also, some of the new greenhouse and lab tests that we're developing in this project are showing some promise too. So I'm hoping we can make a little more progress than we have in the last 40 years on this disease."

A lot more technology today is making the trial simpler. Researchers have much more ability to look at things.

Charcoal rot is one of the bigger problems in Arkansas. The present problem is that researchers can't recommend cultivars. If farmers are having a problem with charcoal rot in their fields, probably their best hope is to avoid drought.

"They can avoid drought in a number of different ways," he said. "Irrigation is the obvious way and today in Arkansas we probably have 60 percent to 70 percent of our soybean acreage irrigated; but it needs to be irrigated properly, so you really don't want to have the plant stressed which can trigger this disease. Other ways of avoiding drought probably includes earlier planting, getting the crop in and out quicker would probably help. If you have a hardpan, ripping the soil may be useful; deep tillage that allows better root penetration would help, and not overplanting. If you have fewer plants out there there's going to be less competition for water. Things like that can help reduce this disease.

"What we're finding with our tests is, even if you don't see obvious symptoms of the disease, we are getting effects on the plants. We can sometime see differences in plant height during the season so there is something going on there. We see this in some of our other soil borne diseases like Phytophthora root rot where we can get damage from that pathogen without seeing any symptoms. Our root pathogens are just tough to work with so we're hoping that by getting some resistance that will take one variable out of the yield picture, give us some tools to work with, and a little more consistent yields. That's our goal, to have consistent yields by taking out diseases that limit yield." Δ

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