Wheat researchers combine forces to battle major disease

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Wheat streak mosaic virus is the most prevalent disease in the southwestern wheat producing region of the U.S., according to a Texas AgriLife Research scientist.

Dr. Charlie Rush, AgriLife Research plant pathologist in Amarillo, is assembling several teams of scientists to work on the disease from every aspect: vector to diagnosis and mapping to control.

"There are other diseases of concern, but wheat streak mosaic is always found somewhere in this wheat growing region, and every couple of years, we have an epidemic of it," Rush said.

Several issues cause the disease to be more problematic, he said. It is hard to distinguish the disease from drought or nutrient deficiencies because the symptoms often look very similar in all three. Also, the vector is so tiny it can't be seen in the field, so the disease is already present before it can be detected. And there are no chemical controls for either the insect or disease.

The disease doesn't just affect grain and forage yields, but also has a very negative impact on the ability of the wheat plant to use irrigation water, Rush said. Therefore, irrigation applied to diseased wheat wastes time, energy and groundwater.

Through a Texas Cropping Systems grant, work was started about a year ago to look at the factors that impact disease incidence and severity,

primarily at the vector, which is the wheat curl mite, Rush said.

In this project, the focus is on trying to understand the dynamics of the wheat curl mite and what conditions cause it to move, said Jacob Price, a research associate working with Rush.

"We are monitoring the movement of the wheat curl mite where it lives on natural rangeland and Conservation Reserve Program grasses and monitoring movements on the southwest winds in the early spring and summer to wheat," Price said.

He said they want to find out where the mite populations live between seasons and if there are environmental factors that perpetuate the movement of the mite and the subsequent wheat viral diseases.

This project includes working with two private producers, as well as on the research farm, Price said. Grass is collected from the fields and the wheat curl mites are washed out and then tested individually to determine if they are carrying the wheat streak mosaic and triticum mosaic viruses.

"In doing so, we can find natural populations of wheat curl mite and determine where the diseases already exist in an area," he said. "Then we will use environmental data to determine if there are certain conditions that cause the mite to move and transport the disease to newly planted wheat fields."

In a separate study, Price planted an area of a wheat field in July and allowed it to become infested with the virus-carrying mites. Now he will plant the remainder of the field to wheat and monitor the movement.

"We want to know how fast they move; how high the populations are when they move; and how quickly we see disease development after a

population of mites enters the field," he said.

Hopefully, Price said, this will help determine environmental factors that prompt movement and allow researchers to inform producers of the likelihood of high wheat streak mosaic infection in any given year.

"This will then allow producers to take certain precautions, such as delaying planting until the mites are no longer moving," he said. "Along with the new information and continued cultural practice of destroying volunteer wheat, we can help limit the risk of general wheat virus infection."

This information could help scientists design future research in pesticide application for the wheat curl mite, which is unknown at this time, Price said.

A separate project under way, funded by the Ogallala Aquifer Program, involves AgriLife Research and scientists with the U.S. Department of Agriculture-Agricultural Research Service at Bushland.

"We know from our previous work that wheat streak mosaic interferes with root development in wheat and restricts water-use efficiency," Rush said. "We also know that wheat streak is progressive and moves across fields.

"What we haven't been able to do," he said, "is to water one area of a field without wasting water on the area damaged by the disease."

Valmont Irrigation has been working with variable-rate nozzling systems for pivot irrigation units that will allow producers to adjust the amounts of water applied in different areas, Rush said. But the system needs a map of the field to tell it where to and where not to water.

"And if it is wheat streak they are dealing with, it's a moving target," Rush said. "So we have to get to a situation of real-time mapping."

Drs. Steve Evett and Susan O'Shaughnessy, USDA scientists at Bushland, have been working with remote sensing attached to the irrigation system to create these real-time maps.

But Rush said the system can't determine if the bad patch is due to a biotic stress, such as greenbugs or wheat streak mosaic, or if it is drought-stressed.

"The system may diagnose the disease as water stress and indicate it needs more water, when it doesn't," he said. "What we are going to do is help increase the precision of that remote sensing to allow them to differentiate a biotic stress from a droughty area."

Rush said his ultimate goal is to get a larger long-term grant from the federal Agriculture and Food Research Initiative program that will allow all the pieces of the research puzzle to be brought together. These grants are highly competitive and to be successful, they require multidisciplinary approaches that study entire agricultural systems.

"We want to be able to present an entire management system to farmers, with remote sensing, variable-rate nozzles, drought-tolerant and disease-resistant varieties of mainly corn and wheat, and specific agronomic practices," he said. "So the AFRI program is perfect for what we want to accomplish.

"We've been conducting pieces of research or laying a lot of bricks in the past for a foundation that we now can put together into one big system and bring it all together for the producers," Rush said.

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