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The Search for New Wheat Streak

Researchers are looking for wheat genes that will provide additional resistance to wheat streak mosaic virus, thanks to funding from the Kansas Wheat Alliance. Yield loss due to wheat streak mosaic virus equaled more than 4.25 million bushels in the 2013 Kansas wheat crop alone, adding up to a $32.6 million economic impact.

Wheat streak mosaic virus flies on the Kansas wind from one wheat field to another - courtesy of its host, the wheat curl mite. As the mites feed on wheat, wild grasses like foxtail, and other plants, they spread the virus from one field to another.

The Kansas wheat crop does not have sufficient protection to avoid yield loss due to the virus's infection. That may soon change as Dr. Guorong Zhang, Kansas State University wheat breeder, is leading this research with his team at the K-State Agricultural Research Center in Hays.

K-State agronomist Jeanne Falk-Jones compares the wheat streak mosaic virus to the flu virus in humans. "It is the toughest on the young because they have a harder time fighting off the virus," she said. "In addition, there is no medicine or treatment to cure the virus. Wheat that is stressed will be more susceptible to severe symptoms. This includes stress from drought, lack of nutrients, or poor growing conditions. "

Known Resistance Exists

Three current genes are known to have wheat streak mosaic virus resistance, referred to by number: *Wsm1*,*Wsm2* and *Wsm3*. Of these three genes, only one is found in conventional wheat - *Wsm2*. The other two genes come from a wild wheat relative, *Thinopyrum intermedium*.

This *Wsm2* gene is important because wheat breeders start by using genes from wheat before exploring the complicated introductions of genes from other wheat relatives.

Four existing wheat varieties include the *Wsm2* gene: RonL, Snowmass, Oakley CL and Clara CL. But, as Zhang pointed out, all these resistant varieties have the same resistance source.

As a result, if the virus evolves under selection pressure and breaks down this resistance, then all the currently-resistant varieties would become susceptible. Therefore, it is necessary to explore new resistant sources and discover new resistance genes, which researchers can then introduce into new varieties or stack with *Wsm2* to make the resistance more durable.

The Challenge of Finding New Resistance Genes

To find new resistance genes for K-State wheat varieties, Zhang and his team are testing 20 new resistant plant introductions (13 from winter-type wheats and seven from spring-type wheats). These have been selected from more than 3,000 germplasm lines, to try and identify if any of these varieties has a gene for wheat streak mosaic resistance other than *Wsm2*.

Among the 13 winter-type wheat lines, Zhang and his team have found two lines that may contain a gene different from *Wsm2*. They have initiated the process to introduce these two resistance sources into their elite breeding lines, which should introduce another barrier for the wheat streak mosaic virus.

Zhang is continuing the search for other unique genes with virus resistance in the seven spring-type resistant sources. His initial testing shows great promise for one line that might have a different resistance gene than *Wsm2*. Early indications are that the resistance gene in this line should be located in a different genomic region than *Wsm2*, which would provide a more durable resistance to wheat streak mosaic virus when stacked with *Wsm2*. Zhang's team is continuing to work on this line to identify its location within the wheat genome and its linked molecular markers.

While the search continues, Zhang's team is zeroing in on this new resistance gene. In the near future, this new gene will be introduced into elite breeding lines and be stacked with *Wsm2* or other resistance genes.

As a result of this Kansas Wheat Alliance-funded research, Kansas farmers will have more protection of wheat crop yield potential thanks to more durable resistance to wheat streak mosaic virus.

The Kansas Wheat Alliance is a not-for-profit organization that was founded in 2007 with the goal of maximizing value for wheat farmers from new wheat varieties developed by Kansas State University and other wheat-breeding programs. The Kansas Wheat Alliance delivers modern genetic technology that is not otherwise showing up in wheat varieties, a real economic benefit to the wheat producers and end-users of the crop.