By Dan Moser

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University of Nebraska-Lincoln scientists are mounting new research and grower education efforts against one of corn's most pernicious pests, the western corn rootworm, amid indications across the Corn Belt that it has adapted to some current Bt toxins.

Three teams of UNL entomologists were awarded more than $1.1 million in three-year grants from Monsanto for research and grower education on western corn rootworm management.

UNL received three of the seven grants Monsanto awarded nationally this year from its Corn Rootworm Knowledge Research Program. Monsanto established the program in 2012 with a $3 million pledge and continued its support of the program with an additional $3 million commitment in 2013. The program is intended to increase understanding of corn rootworm biology and lead to economical, practical and sustainable solutions for farmers.

The new grants come amid signs in Nebraska and elsewhere across the Corn Belt that corn rootworms are becoming resistant to some transgenic corn traits.

Corn rootworms destroy corn roots, thereby reducing yield. The loss of roots also causes plants to fall over during strong wind and rain, making harvest difficult. Over the years, corn rootworms have become resistant to a diverse set of technologies used to control them. It's estimated corn rootworms cost growers $1 billion a year in yield loss and control costs.

The projects, led by Nick Miller, Blair Siegfried and Doug Golick, all in UNL's Department of

Entomology, will conduct research on resistance to transgenic corn and chemical insecticides, and develop technology-enhanced educational tools to help growers make informed decisions about managing corn rootworms. Scientists from UNL's Department of Agronomy and Horticulture as well as entomologists from Iowa State, University of Missouri, and Kansas State Universities will join these teams.

Other UNL entomologists involved in the work are Lance Meinke, Bob Wright, Tom Hunt and Gary Hein. Don Lee of agronomy and horticulture also is involved.

Meinke said ongoing research and extension efforts are key to staying on top of the corn rootworm. Scientists recently confirmed rootworms have become resistant to two kinds of Bt toxins included in corn, mCry3Bb1 and mCry3A. Producers and crop consultants first started reporting concerns in 2011, initially in southwest and northeast Nebraska.

Testing is continuing, both in labs and fields, Meinke said, adding that it is not unusual for corn rootworms to adapt to various toxins.

"Corn rootworm has a long history of adapting to anything we throw at it," Meinke said.

As research findings are compiled, they will be used by UNL Extension faculty for outreach to producers. Flexible, up-to-date management strategies are key to fighting the pest, Meinke said. For example, producers are moving from single-trait corn to "pyramided traits" in hopes that while rootworm might become resistant to one trait in the seed, they won't to another.

It's key that producers do not view any single trait as a "silver bullet," Meinke added. In addition to planting corn with pyramided traits, crop rotation continues to be a useful weapon against corn rootworm.

Integrated pest management is more labor- and knowledge-intensive but also much more effective in the long term, Meinke said.

Educational tools from these grants are expected to include a series of mobile and web-based interactive learning experiences for growers, consultants, extension educators, and post-secondary students teaching fundamental concepts related to resistance management strategies for the corn rootworm. These modules will teach science-based concepts related to current knowledge on corn rootworm biology, behavior, IPM strategies, resistance management strategies, toxicology and population genetics.

This is the second year UNL scientists have received funding from Monsanto's western corn rootworm program. Last year, Brigitte Tenhumberg of the School of Biological Sciences received a grant to evaluate integrated resistance management strategies in variable environments. Her research uses mathematical models to evaluate a range of resistance management strategies to identify those likely to work best in delaying onset of resistance evolution.