RESISTANCE TO ACETOLACTATE SYNTHASE-INHIBITING HERBICIDES IN GRAIN SORGHUM. Kassim Al-Khatib, Kellan S. Kershner, and Mitch Tuinstra, Kansas State University, Manhattan, KS, and Purdue University, West Lafayette, IN.

Weed infestations is a major problem in sorghum production. A 2006 survey of sorghum producers in the United States by Kansas State University Sorghum Improvement Center showed that new technologies for controlling weeds was thought to be one of the highest priorities for research. In addition, producers repeatedly noted the need to develop better and more economical weed management strategies for sorghum. Currently, many grain sorghum producers use preplant herbicides such as atrazine and metolachlor, followed by postemergence herbicides such as atrazine, 2,4-D, and dicamba. These herbicides generally work well for managing weeds given adequate precipitation; however, erratic rainfall and poor soil moisture are common in most sorghum producing regions. Under dry conditions, preplant herbicides often fail or perform poorly and weeds can become a problem.

Nicosulfuron and rimsulfuron are acetolactate synthase (ALS)-inhibiting herbicides that widely used to control broadleaf and grass weeds in corn. These herbicides are popular with corn growers because of relative low use rate, low mammalian toxicity, low surface and ground water contamination, and high selectivity. These herbicides control several troublesome grass weeds that are common in corn fields. Unfortunately, nicosulfuron and rimsulfuron can not be used on sorghum because sorghum is susceptible to these herbicides.

A project was initiated in 2003 to develop and ultimately commercialize sorghum varieties with tolerance to ALS-inhibiting herbicides. The development of this technology would allow for more effective postemergence grass control for sorghum producers and also improve crop rotation and replant options for farmers interested in planting sorghum in fields sprayed with ALS-inhibiting herbicides in the previous crop (e.g. hail- or frost-damaged wheat). A natural sorghum mutant with high levels of tolerance to ALS-inhibiting herbicides was identified. Genetic crossing and backcrossing was used to transfer this trait into elite grain sorghum varieties. Tolerance appeared to be controlled by a single, incompletely-dominant, target-site mutation and at least 2 other modifier genes and provides cross-resistance to several different herbicides in the imidazolinone (IMI) and sulfonylurea (SU) chemical families. As part of this effort, Kansas State University and the Kansas State University Research Foundation developed and released two sets of sorghum materials with tolerance to ALS-inhibiting herbicides in 2007. The first set of materials was released in the spring season with seed of 18 ALS-herbicide tolerant sorghum families representing an array of commercially important sorghum seed and pollinator genetic backgrounds made available to commercial seed industry. A second release of 34 ALS herbicide tolerant sorghum inbred lines was released in the fall season as potential parent lines for development of ALS-herbicide tolerant hybrids.

Despite these potential benefits, concerns have been raised regarding the development and commercial release of herbicide tolerance traits because of risk for development of herbicide-resistant weeds, weed population shifts, and gene flow of the herbicide tolerance trait to wild relatives. Sorghum crosses freely with several wild relatives including shattercane. Although we anticipate concern over development of herbicide tolerance in sorghum, the mutants used in these studies were found in wild sorghum accessions so there is no risk of transferring new herbicide tolerance genes into natural sorghum populations. The herbicide tolerance genes are already present in nature. Based on this and other arguments, the most difficult registration and risk assessment hurdles can be overcome.