KANSAS SOYBEAN COMMISSION FINAL REPORT

Principal Investigators: Phillip W. Stahlman, ARCH and Mithila Jugulam, Department of Agronomy

Title: Risk of Stacked Dicamba and Glyphosate Resistance in Kochia and Best Management Practices

Amount of Funding: $22,910

Department Head(s): Robert Gillen and Gary Pierzenski

Progress Report: March 1, 2014-February 28, 2015

**Confirmation of resistance to dicamba in kochia.** Greenhouse experiments were conducted to determine the susceptibility of various kochia populations from throughout western Kansas to dicamba. Eleven of 37 kochia populations previously screened for response to dicamba were selected for additional testing. Fresh and dry plant weights, plant morality, and visual growth reduction were determined 4 weeks after treatment. Among those 11 populations there was a 7-fold difference in susceptibility to dicamba. Fresh and dry plant weights were similar and the ED50 (effective dose required to cause 50% growth reduction) indicated that the least susceptible population required a 7-times higher dose compared to the least susceptible population to achieve an equal biomass reduction. Dicamba at 0.5 lb/A (16 fl oz) provided only 20% mortality and 50% reduction in biomass of surviving plants of the least susceptible population, which also is resistant to glyphosate. This and other supporting evidence confirms dicamba-resistant kochia presence in Kansas and highlights the importance of diverse management practices to prevent further evolution of kochia resistance to dicamba. The mechanism of resistance is not yet known, however related research on a population from Haskell County, Kansas indicates that dicamba resistance is not due to differences in uptake, translocation or metabolism of dicamba. Furthermore, another population from Finney County, Kansas was found to be resistant to four herbicide modes of action: synthetic auxins (dicamba), ALS-inhibitors (sulfonylurea herbicides), PSII inhibitors (triazine herbicides), and EPSPS inhibitors (glyphosate). This is the first reported case of resistance to four herbicide modes of action.

**Preemergence versus postemergence kochia control with dicamba.** Dicamba is most commonly used as a postemergence herbicide but field research in 2010 and 2011 determined that dicamba controlled kochia better when applied preemergence than when applied postemergence. However, sometimes control was not complete raising concern that preemergence-applied dicamba could select for higher-level resistance than has resulted from postemergence use. The response of three kochia accessions from Pratt, Greely, and Gray Counties in Kansas to preemergence and postemergence dicamba applications were tested in replicated and repeated greenhouse experiments. Results confirmed earlier findings that dicamba was considerably more effective when applied preemergence than when applied postemergence, both in terms of plant mortality (Figure 1) and plant fresh weight (Figure 2). There were differences among the accessions in response to dicamba. Preemergence-applied dicamba a 0.375 lb/A (6 fl oz) provided 95% mortality of the Pratt Co. accession compared to 84 and 87% mortality for the Greeley and Gray Co. accessions, respectively (Figure1). Mortality of all three accessions was increased slightly by increasing dicamba doseage to 0.5 lb/A (8 fl oz).

Figure 1. Number of live plants per treated area for three kochia accessions in response to dicamba treatment.

The Greeley and Gray Co. accessions were much less susceptible to postemergence-applied dicamba than the Pratt Co. accession (Figure 2). Dicamba at 0.5 lb/A (8 fl oz) reduced plant fresh weight of the Pratt Co. accession by 39% compared to only 14 and 7% reductions, respectively, for the Greeley and Gray Co. accessions.

Figure 2. Plant fresh weight per treated area for three kochia accessions in response to dicamba treatment.

This experiment confirmed the effectiveness of preemergence-applied dicamba in controlling kochia but also found differences in effectiveness among the accessions tested. The implications are that dicamba should only be used in combination with another herbicide mode of action to prevent selection for dicamba resistance.

**Outreach.**  The principal investigator or his students presented eight times on kochia management at professional meetings and 12 times at field days, retailer, consultant, and extension meetings in Kansas, Colorado and South Dakota.