Resistance Kochia Management

A glyphosate-resistant biotype of kochia (Kochia scoparia L. Schrad) has been confirmed, or is likely, in many of the states on the Great Plains. In order to minimize the spread of glyphosate resistant kochia, best management practices need to be used when spraying glyphosate products, along with a tank-mix as a proactive approach to control the weed.

**Background**
The number of confirmed and suspected glyphosate-resistant kochia populations are spreading. Western Kansas has the highest number of confirmed cases of resistance, and it appears to be moving west and north (Figure 1).

Monsanto has been collaborating with universities in Kansas, Colorado, South Dakota, North Dakota, Montana, and Wyoming to develop recommendations and best management practices for control of glyphosate-resistant kochia. Because populations of kochia are mixtures of tolerant and resistant biotypes, it is difficult to predict whether Roundup brand agricultural herbicides will be effective when used alone in fields with infestations of kochia. Therefore, Monsanto recommends a tank-mixture be used as a proactive approach to control kochia.

Kochia is a summer annual broadleaf weed that is becoming more common and difficult to control in cropland (Figure 2). Kochia germinates very early in the spring, and continues to germinate throughout the growing season. Seeds of kochia are typically found on the soil surface or at very shallow depths in the soil. Unpublished results of ongoing research at several Universities suggest that seeds of kochia are short-lived in the soil. Kochia produces large quantities of seed that can spread long distances very rapidly. The seed is dispersed in the fall when kochia becomes similar to “tumbleweeds” dropping seeds as they blow around (Figure 3.) Kochia plants are tolerant of drought and saline soils, and do well under growing conditions considered poor for most crops.

**Management Recommendations**
To control glyphosate-resistant kochia, tank mixes of Roundup® agricultural herbicides and herbicides with other modes of action need to be used. Producers need to be proactive and develop a long-term plan that targets kochia management during all phases of the cropping system.

A majority of kochia emerges in March. Herbicide applications should be made just prior to kochia emergence or when kochia is small and most susceptible to burndown herbicides and before kochia begins rapid vegetative growth. A second application of residual herbicides will be necessary at planting to extend residual control of kochia.

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*Minimum Herbicide Guidelines for Corn*
- **In March** - Apply a tank mix of 0.375 to 0.5 lbs a.e./acre dicamba plus 0.5 to 1.0 lbs/acre atrazine (depending on soil type), plus a full labeled rate of a Roundup® brand agricultural herbicide.
- **At planting** - Use a residual herbicide such as Harness® Xtra brand herbicide plus a Roundup® brand agricultural herbicide.
- **Monitor in-crop kochia escapes** - Apply a full labeled rate of a Roundup® brand agricultural herbicide plus Status® or Impact® herbicides.
- **Fields with heavy kochia infestations** - Add an additional HPPD residual herbicide (isoxaflutole or mesotrione) to the tank mixtures in March and at-planting applications.

*Minimum Herbicide Guidelines for Soybean*
- **In March** - Apply a tank mix of metribuzin with a full labeled rate of a Roundup® brand agricultural herbicide and a 2,4-D herbicide product. Replace 2,4-D with a dicamba product where label restrictions permit preplant dicamba applications.
- **At planting** - Make sure weeds are controlled prior to
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planning, then apply a tank mixture of a residual herbicide (such as Authority®, Assist, Authority® XL, Gangster®, Valor® SX, Valor® XLT, herbicides) plus a Roundup® brand agricultural herbicide. Use a combination of the residual herbicides metribuzin plus sulfentrazone in fields with heavy kochia infestations.

- **Monitor in-crop kochia escapes** - Apply a tank-mix with a full labeled rate of a Roundup® brand agricultural herbicide plus lactofen. This recommendation will likely only provide suppression of glyphosate-resistant kochia. There are currently no labeled herbicide combinations that provide excellent postemergence control of glyphosate-resistant kochia.

**Minimum Herbicide Guidelines for Wheat**

- **In March to April** - Apply a residual wheat herbicide to the growing wheat crop in the spring to keep kochia under control. Don't rely solely on post-harvest applications to keep wheat stubble clean.

- **Post-harvest** - Apply 0.25 to 0.5 lbs a.e./acre dicamba plus 0.5 lbs a.e./acre 2,4-D plus a full labeled rate of a Roundup® brand agricultural herbicide to small, actively growing kochia. For fields with heavy infestations of glyphosate-resistant kochia, an alternative herbicide program may need to be used.

In all crops, promote crop competition and canopy closure by planting high quality crop seed at the optimum planting date and seed depth, with fertilizer placed in close proximity to the seed row. As a last resort, conservation tillage equipment such as sweeps/V-blades may need to be considered prior to planting or row cultivation to control kochia.

**Additional Management Recommendations**

- Spray volume greater than 10 gallons per acre should be used to provide adequate spray coverage of dense kochia plants.

- Kochia has narrow leaves and a small canopy, especially during early growth stages. Make sure to use nozzles that can provide adequate coverage. Follow all manufacturer recommendations to help improve coverage and minimize the risk of drift onto sensitive crops.

- Ammonium sulfate (AMS) at 2% v/v or 17 lbs/100 gallons of spray mix should be used. Additives other than AMS may be included, but AMS at the recommended rate should be used.

- Always use full labeled and recommended rates of herbicides and AMS.

- Sprayers should be operated at less than 15 MPH, less than 10 MPH is preferred.

- Spray early and don't wait to spray mature weeds. Monitor unexplained kochia escapes following a glyphosate application.

- Always use tank-mix herbicides with alternative modes of action whenever possible.

- The use of residual herbicides helps to control additional flushes of kochia and prevent seed production.


Figure 3. Kansas field infested with kochia. Photo courtesy of Phil Stahlman, Kansas State University, 2010, Greeley County, KS.