Kochia Management in Soybeans

Management of this summer annual weed is vital – kochia can reduce soybean yields by 70 percent or more.

Kochia Distribution and Biology

- Kochia is well adapted to the Great Plains and western regions of the U.S. and Canada because it is tolerant to hot, dry conditions and soils with high salinity.
- Kochia can produce up to 30,000 seeds per plant, and seeds are dispersed through a tumbling mechanism when the mature plant breaks off at the base and becomes a tumbleweed.
- Kochia can emerge as early as February and March in the northern Great Plains, but germination can extend through August throughout the Great Plains states. Kochia is especially hard to control because seeds initiate germination within two to three hours under favorable conditions, and seedlings establish quickly.
- Kochia is competitive with crops and problematic in fallow periods between crops. Early-emerging kochia can reduce crop yields by 70 percent or more and can also interfere with harvest.
- Kochia has an alternating arrangement of linear leaves that are covered with dense hairs. It can grow to a height of 6 feet and has a spherical shape, especially when growing with limited competition. Kochia roots can extend down 15 feet and measure 21 feet in diameter.

Herbicide Resistance in Kochia

Evolution of herbicide-resistant kochia is rapid due to high genetic diversity, short seed life (one to three years) and heavy reliance on herbicides for control in minimum- and no-till cropping systems. Resistance has been confirmed in kochia to the five different herbicide sites of action listed in Table 1.

Many kochia populations are resistant to two or more of the herbicide sites of action listed in Table 1. In Kansas, resistance to Groups 2, 4, 5, and 9 has been confirmed in a single population. In North Dakota, a population was recently confirmed resistant to Groups 2, 4, 9 and 14.

Chemical control of even non-herbicide-resistant kochia can be difficult due to application and spray coverage issues, inadequate herbicide rates, adjuvant selection, plant size and environmental stress at time of application.

Photo Credit: Sarah Lancaster, Kansas State University

Seedling kochia plant

Table 1. Herbicide resistance in kochia has been confirmed in these sites of action.

Group #	Group 2	Group 4	Group 5	Group 9	Group 14
Site of Action	ALS Inhibitors	Synthetic Auxins	Photosystem II Inhibitors	EPSP Synthase Inhibitors	PPO Inhibitors
Herbicide Product Examples	Chlorsulfuron (Glean), metsulfuron (Ally), imazethapyr (Pursuit), thifensulfuron (Harmony)	Dicamba (several), fluroxypyr (Starane)	Atrazine (several), metribuzin (several)	Glyphosate (several)	Carfentrazone-ethyl (Aim), flumioxazin (Valor), saflufenacil (Sharpen)

Management of Kochia in Soybeans

1. Rotate crops. Crop rotation is important to help diversify kochia-control strategies and herbicide programs over time.

   — More effective kochia herbicidesare available in grass crops than in broadleaf crops, especially for postemergence control. A competitive winter wheat crop can greatly suppress kochia emergence and growth.

2. Start clean. It is imperative to control kochia in early spring because of its emergence patterns, dense populations and difficult-to-control large plants.

— Kochia should be controlled at or before planting.

— Very few effective postemergence herbicides are available for kochia control in broadleaf crops.

3. Apply an effective soil-applied, pre-emergence herbicide. Kochia can be controlled by a number of residual herbicides if activated before germination.

— Residual herbicides should be applied in late fall or very early spring to be activated before kochia starts to germinate.

— Early season control with pre-emergence residual herbicides greatly reduces the reliance on postemergence herbicides for control.

4. Target small weeds after they emerge. Timing of the herbicide application is critical for postemergence control of kochia.

— To optimize herbicide performance, apply postemergence herbicides with the recommended adjuvants, tank-mix partners, spray volumes and application guidelines before kochia grows taller than 2-3 inches.

— It's important to note, very few postemergent control options exist for non-herbicide-tolerant soybean crops, which stresses the need for early control and prevention measures.

5. Prevent seed production. Kochia is day-length sensitive and begins flowering in late July and August. Due to its short seed life, killing kochia before it flowers and produces seed is an effective way to manage it. Nonchemical management tactics such as strategic tillage, cover crops, and barriers can complement herbicide applications to reduce seed production.

— Fall cover crops can suppress kochia establishment and out-compete young seedlings in the spring.

— Tillage controls kochia by disrupting the roots and dehydrating plants, but it also depletes soil moisture and leaves soil more vulnerable to wind and water erosion.

— Barriers help control escapes by restricting field-to-field movement of kochia seed due to wind.

Table 2.

Preemergence herbicides for kochia control.

Herbicide	Group #	Crops	Comments
Dicamba	4	Dicamba-tolerant crops	Some resistant populations have been confirmed.
Sulfentrazone and flumioxazin	14	Corn & sorghum (flumioxazin products only), soybean	Some resistant populations have been confirmed.
Metribuzin and atrazine	5	Corn & sorghum, soybean (metribuzin only)	Some resistant populations have been confirmed.
Pyroxasulfone	15	Corn, sorghum, soybean, wheat (delayed PRE)	Must be activated (incorporated) by at least 1/2 inch rainfall or irrigation
Isoxaflutole	27	Corn	Add atrazine to optimize control.

Postemergence herbicides for kochia control.

Herbicide	Group #	Crops	Comments
Dicamba, dichlorprop and fluroxypyr	4	Fallow, corn, sorghum & wheat, dicamba-tolerant crops	Some resistant populations have been confirmed.
Glufosinate	10	Burndown, glufosinate-tolerant crops	Apply to small plants with high spray volume and ammonium sulfate. Less effective in dry conditions
Glyphosate	9	Burndown, fallow, glyphosate-tolerant crops	Many resistant populations have been confirmed.
Mesotrione, tembotrione, topramezone, tolypyralate	27	Corn, sorghum (mesotrione products only)	Add atrazine to optimize control. Use recommended adjuvants.
Pyrasulfotole/bicyclopyrone/tolpyralate & bromoxynil	27 & 6	Sorghum (pyrasulfotole & bromoxynil only), wheat	----------

Photo Credit: Sarah Lancaster, Kansas State University

Young kochia plant in a wheat field.

For more information and resources, visit www.growiwm.org/Take-Action-Home

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Take ACTION Herbicide-Resistance Management