Bassia scoparia (L.) A.J. Scott; kochia
(=*Kochia scoparia* (L.) Schrad.)
Bassia hyssopifolia (Pall.) Kuntz; fivehook bassia

Kochia and fivehook bassia

Family: Chenopodiaceae
Range: All western states, except North Dakota for *Bassia hyssopifolia*.
Habitat: Roadsides, fallow fields, crop fields, ditch margins, seasonal wetlands, and residential areas. Kochia predominately inhabits upland sites especially following soil disturbance. Fivehook bassia is a facultative wetland indicator species and often associated with alkaline areas. Both species tolerate alkaline or saline soil, drought, and frost.
Origin: Both species are native to Eurasia.
Impacts: These weeds spread rapidly and can form dense stands. Thick stands increase fuel loads and fire hazard, obstruct right-of-ways, and compete with desirable plants for limiting resources. Foliage contains mild toxins and nitrates and can be toxic to livestock in large quantities.
Western states listed as Noxious Weed: *B. scoparia*: Arizona, Oregon, Washington
California Invasive Plant Council (Cal-IPC) Inventory: Both plants are listed as Limited Invasiveness

Kochia and fivehook bassia are erect summer annuals that grow to 4 ft tall or more. In the vegetative state, these species are very difficult to distinguish from one another. The foliage is generally gray-green and covered with soft hairs. The leaves are mostly alternate, flat, linear-lanceolate to lanceolate. Kochia often appears leafier than fivehook bassia. Kochia stems sometimes appear reddish late in the season. Both species have a taproot, usually with few to several branched, fibrous lateral roots. Kochia litter appears to have allelopathic properties that affect certain plants.

Both kochia and fivehook bassia flower in late summer to early fall. They develop spikes of inconspicuous flowers that lack petals. Fivehook bassia fruit have five small 1-mm long hooked spines. Kochia fruit have five thickened or knoblike lobes, or sometimes short, horizontal wings, less than 1 mm long and wide. Fruits contain one horizontal seed and remain enclosed within the calyx. The senesced plants break off at the base and scatter seed as they tumble with the wind. Both species produce abundant seed. Seeds germinate in spring. Because seeds generally are not deeply buried, they usually survive only 1 to 2 years.

NON-CHEMICAL CONTROL

Mechanical (pulling, cutting, disking)	Small infestations can be removed by manual methods. Digging and hand-pulling are effective. When digging, sever the root below the soil surface. Mowing can reduce seed production. Mow before flowering to prevent seed production. On sites with high soil moisture, plants need to be remowed frequently to prevent regrowth. Shallow tillage will control emerged plants but often stimulates recruitment. Deep tillage can reduce populations by burying seed deep enough to prevent germination. Land managers that use tillage for seedbed preparation during reseeding should prepare for a flush of seedlings when soils become saturated.
Cultural	Plants will frequently regrow following grazing. Grazing can reduce populations when small plants are grazed intensively. Kochia can provide good livestock forage in small amounts, although foliage contains mild toxins and nitrates and can be toxic to livestock in large quantities. Fivehook bassia is considered fair

	forage for sheep in small amounts. The foliage contains variable amounts of potassium oxalate which is toxic in large amounts and an unidentified substance that can cause digestive tract problems. Burning is not an effective control. In Colorado, good control of kochia was achieved using a propane flamer to sear seedlings less than 1 inch tall. Promoting competitive vegetation can slow spread and help prevent establishment. Perennial grass plantings have been shown to inhibit kochia establishment. Perennial grass stand density and vigor should be managed to minimized bare ground exposure.
Biological	No known biological controls for either species are available in the United States.

CHEMICAL CONTROL

The following specific use information is based on published papers and reports by researchers and land managers. Other trade names may be available, and other compounds also are labeled for this weed. Directions for use may vary between brands; see label before use. Herbicides are listed by mode of action and then alphabetically. The order of herbicide listing is not reflective of the order of efficacy or preference.

GROWTH REGULATORS	
Aminocyclopyrachlor + chlorsulfuron *Perspective*	**Rate:** 4.75 to 8 oz product (*Perspective*)/acre **Timing:** Both postemergence and preemergence. Postemergence applications are most effective when applied to small plants. **Remarks:** *Perspective* provides broad-spectrum control of many broadleaf species. Although generally safe to grasses, it may suppress or injure certain annual and perennial grass species. Do not treat in the root zone of desirable trees and shrubs. Do not apply more than 11 oz product/acre per year. At this high rate, cool-season grasses will be damaged, including bluebunch wheatgrass. Not yet labeled for grazing lands. Add an adjuvant to the spray solution. This product is not approved for use in California and some counties of Colorado (San Luis Valley).
Dicamba *Banvel*, *Clarity*	**Rate:** 0.5 to 2 pt product/acre (0.25 to 1 lb a.e./acre) **Timing:** Postemergence. Most effective on seedling and small plants. **Remarks:** Dicamba is a broadleaf-selective herbicide often combined with other active ingredients, particularly 2,4-D (0.5 to 1 pt dicamba + 2 pt 2,4-D/acre). Some kochia populations have developed resistance to dicamba. Where resistance is suspected, use other herbicides or combinations. Dicamba is available mixed with diflufenzopyr in a formulation called *Overdrive*. This has been reported to be effective on kochia. Diflufenzopyr is an auxin transport inhibitor which causes dicamba to accumulate in shoot and root meristems, increasing its activity. *Overdrive* is applied postemergence at 4 to 8 oz product/acre to rapidly growing plants. Higher rates should be when treating perennial weeds. Add a non-ionic surfactant to the treatment solution at 0.25% v/v or a methylated seed oil at 1% v/v solution.
Fluroxypyr *Vista XRT*	**Rate:** 6 to 22 oz product/acre (2.1 to 7.7 oz a.e./acre) **Timing:** Postemergence from seedling to bloom stage. **Remarks:** Fluroxypyr is a broadleaf-selective herbicide. It can also be effective on larger plants, but has no soil residual activity. It is recommended for herbicide resistant biotypes. Add a methylated seed oil surfactant.
AROMATIC AMINO ACID INHIBITORS	
Glyphosate *Roundup*, *Accord XRT II*, and others	**Rate:** 2 to 3 pt product (*Roundup ProMax*)/acre (1.1 to 1.7 lb a.e./acre). Spot treatment: 0.5% to 1% product v/v **Timing:** Postemergence from seedling to bloom stage. **Remarks:** Glyphosate will only provide control during the year of application; it has no soil activity and will not kill seeds or inhibit germination the following season. Glyphosate has is nonselective. It can create bare ground conditions that are susceptible to weed recruitment. In areas with desirable vegetation, use spot treatment. Glyphosate is a good control option if reseeding is planned shortly after application, as it will not injure seedlings emerging after application. Add a surfactant when it is not already included in the herbicide formulation (e.g., *Rodeo*, *Aquamaster*). Glyphosate resistant biotypes of kochia have been reported.

BRANCHED-CHAIN AMINO ACID INHIBITORS	
Chlorsulfuron *Telar*	**Rate:** 1 oz product/acre (0.75 oz a.i./acre) **Timing:** Preemergence or postemergence from seedling to bolting stage. **Remarks:** Chlorsulfuron has mixed selectivity, but is generally safe on grasses. Always use a surfactant. It can be tank-mixed with 2,4-D for quicker burndown. Chlorsulfuron is included with aminocyclopyrachlor in *Perspective*. *Telar* can be used near water, but cannot be applied to water. Some kochia populations have developed resistance to related herbicides. Where resistance is suspected, use other herbicides or combinations.
Imazapic *Plateau*	**Rate:** 8 to 12 oz product/acre (2 to 3 oz a.e./acre) **Timing:** Preemergence to early postemergence. **Remarks:** Imazapic is safe for most native grasses. Higher rates may suppress seedlings of some cool-season grasses. Add a methylated seed oil. Some kochia populations have developed resistance to related herbicides (ALS inhibitors). Where resistance is suspected, use other herbicides or combinations. It can be used in combination with glyphosate (premix trade name of *Journey*). Imazapic is not registered for use in California.
Imazapyr *Habitat*	**Rate:** 1 to 2 qt product/acre (0.5 to 1 lb a.e./acre) **Timing:** Can be applied preemergence or postemergence. **Remarks:** Imazapyr has soil residual activity and may impact restoration efforts. Add a spray adjuvant. Some kochia populations have developed resistance to related herbicides. Where resistance is suspected, use other herbicides or combinations.
Metsulfuron *Escort*	**Rate:** 1 to 2 oz product/acre (0.6 to 1.2 oz a.i./acre) **Timing:** Preemergence or postemergence from the rosette up until flower bud stage. **Remarks:** Always use a surfactant. Metsulfuron can be tank-mixed with 2,4-D for quicker burndown. Other premix formulations of metsulfuron can be used at similar application timing. These include *Cimarron Max* (metsulfuron + dicamba + 2,4-D) and *Cimarron X-tra* (metsulfuron + chlorsulfuron). Some kochia populations have developed resistance to related herbicides. Where resistance is suspected, use other herbicides or combinations. Metsulfuron is not registered for use in California.
Propoxycarbazone-sodium *Canter R+P*	**Rate:** 0.9 to 1.2 oz product/acre (0.63 to 0.84 oz a.i./acre) **Timing:** Postemergence to young, rapidly growing plants. **Remarks:** Propoxycarbazone is a broad-spectrum herbicide that will control many species. It will provide only partial control of kochia. Perennial grass species vary in tolerance. A non-ionic surfactant should be added at 0.25 to 0.5% v/v solution.
Rimsulfuron *Matrix*	**Rate:** 4 oz product/acre (1 oz a.i./acre) **Timing:** Preemergence or postemergence to small plants. **Remarks:** Rimsulfuron controls several annual grasses and broadleaves. Perennial grasses are tolerant to fall applications when established and grown under dryland conditions. Application to rapidly growing or irrigated perennial grasses may result in their injury or death. It provides soil residual control in cool climates but degrades rapidly under warm conditions. Rimsulfuron will not control summer annual weeds when applied in fall or spring. Add a surfactant when applying postemergence. Some kochia populations have developed resistance to related herbicides. Where resistance is suspected, use other herbicides or combinations.
PHOTOSYNTHETIC INHIBITORS	
Hexazinone *Velpar L*	**Rate:** 2 to 6 pt product/acre (0.5 to 1.5 lb a.i./acre) **Timing:** Preemergence. **Remarks:** Hexazinone has mixed selectivity and has fairly long soil residual activity. High rates of hexazinone can create bare ground, so only use high rates in spot treatments.

RECOMMENDED CITATION: DiTomaso, J.M., G.B. Kyser et al. 2013. *Weed Control in Natural Areas in the Western United States*. Weed Research and Information Center, University of California. 544 pp.