envu™ Vegetation Management

Kochia

The problem

Kochia is one of the most difficult-to-control weeds in western Canada because of its early germination, deep root system, prolific seed production, and potential herbicide resistance. By the time a kochia plant is only 1 cm tall, the root system can be over 5 cm long (Figure 1) quickly growing below the reach of typical herbicides. A full-grown plant can send roots up to 5 m deep and 7 m wide in search of moisture allowing them to withstand drought conditions much more efficiently than other broadleaf plants. Additionally, a wind-blown kochia plant can cover two miles a day, scattering 15,000–25,000 seeds along the way. These characteristics can allow kochia to quickly overtake rights-of-way and reach heights of 1–1.5 m, blocking sightlines and creating a public safety hazard. Furthermore, kochia can be toxic to livestock and may cause death if consumed in large quantities (over 50% of feed).

What to look for

Kochia is a summer annual broadleaf that reproduces solely by seed. Kochia seeds are 1.5 to 2.0 mm in length, brown, and irregularly shaped with grooved sides (Figure 2). The early leaves of kochia seedlings form a rosette and are covered in soft hairs (Figure 3). The wide genetic diversity of kochia plants has led to multiple adult plant phenotypes but, in general, adult kochia plants have many branches with stems that can be red-tinged. Numerous, hairy, pale green leaves are tapered to points at the tips with an alternate arrangement (Figure 4). Kochia plants form flower clusters from mid-summer to early fall. The flower clusters are inconspicuous as they do not form petals, are green, and stalkless. In the fall, the leaves turn purplish-red and flowers set seed before the entire plant dries out and becomes a tumbleweed that enables the spread of the seeds as the plant rolls with the wind.

Figure 1: Kochia seedling with deep roots
Photo: Derek Sebastian, Envu

Figure 2: Kochia seeds
Photo: Vicki Maloney, Envu

Figure 3: Kochia seedlings
Photo: Derek Sebastian, Envu

Figure 4: Mature kochia
Photo: Derek Sebastian, Envu

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Resistance issues

The wide genetic diversity of kochia plants that is evident by their highly variable phenotypes is also what allows kochia biotypes to develop herbicide resistance mechanisms. That, combined with cross-pollination, short seed viability age, and prolific seed production allows kochia to develop herbicide resistance mechanisms relatively quickly. A randomized–stratified survey of 319 sites in Alberta that was conducted in 2021 (Geddes *et al.*, 2022) reported that, in addition to nearly complete resistance to acetolactate synthase (ALS) inhibitors, 78% of kochia is resistant to glyphosate, 44% is resistant to fluroxypyr, and 28% is resistant to dicamba. Additionally, triple herbicide-resistant kochia samples, resistant to ALS inhibitors, glyphosate, and at least one synthetic auxin, were found at 45% of the sites. The presence of herbicide-resistant kochia populations is why it is important to follow best management practices, including using full-label rates, applying pre-emergence or when plants are small, and using different classes of herbicides.

Envu solutions

Pre-emergent solutions

The majority of kochia seeds do not last more than one year in the soil. Therefore, most kochia problems result from plants that have set seed in the previous year. Applying Esplanade® and Navius® FLEX before kochia emerges delivers the most effective control, especially in areas of western Canada that experience heavy kochia pressure. Applications can be made at any time, except when the ground is frozen or covered in snow. However, studies have shown that fall applications that include Esplanade® can increase the efficacy of kochia control as the active ingredient in Esplanade®, indaziflam, remains in the top layer of the soil and will be present before germination occurs the following spring.

Post-emergent solutions

Because of kochia's early germination, fast-growing, deep, and branched root system, post-emergent control can vary. Kochia seedlings are frost-tolerant and therefore can germinate in the early spring enabling kochia to be at advanced stages of growth before other broadleaf weeds are ready to spray. Furthermore, small emerging kochia seedlings have leaves that are densely covered in small, fine, white hairs that can reduce foliar absorption of herbicides by suspending droplets above the leaf cuticle on the leaf hairs. Additional flushes can also occur throughout the growing season further exacerbating control issues. Applying Navius® FLEX to kochia plants when they are 5–10 cm tall can improve control. If kochia plants are taller than 10 cm, or for heavy infestations, include a tank mix partner such as glyphosate as appropriate for the use site. Effective control requires complete spray coverage of the foliage. Use application equipment that gives the best coverage of all kochia plants while minimizing spray drift. Remember, taller plants, railroad ties, guardrails, and other obstacles can shield or shadow smaller plants and limit contact with shorter kochia.

Application type	Solution	Rate	Application timing
Pre-emergent	Esplanade® + Navius® FLEX + 0.25% v/v non-ionic surfactant	375 mL/ha + 167 g/ha	Fall before the first frost or mid-April
Pre- and post-emergent bareground	Esplanade® + Navius® FLEX + glyphosate* + 0.25% v/v non-ionic surfactant	375 mL/ha + 167 g/ha + 1.5 – 8.0 L/ha	Spring emergence period-preferable before kochia grows to 10 cm in height
Post-emergent selective weeding	Navius® FLEX + 0.25% v/v non-ionic surfactant	167 g/ha	Spring emergence period-preferable before kochia grows to 10 cm in height

*Glyphosate must be added once weeds have emerged.

Charles M. Geddes, Mattea M. Pittman, Linda M. Hall, A. Keith Topinka, Shaun M. Sharpe, Julia Y. Leeson, and Hugh J. Beckie. 2022. Increasing frequency of multiple herbicide-resistant kochia (Bassia scoparia) in Alberta. Canadian Journal of Plant Science. 103(2): 233-237. https://doi.org/10.1139/cjps-2022-0224

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