



Mechanical patch management of kochia

CATEGORY [weeds](#) | February 18, 2025

Mowing and chaff mulch were the most effective and least costly non-herbicide kochia patch management treatments.

Kochia herbicide resistance has become widespread on the Canadian Prairies. Kochia populations have now been identified as having resistance to Groups 2, 4, 9 and 14, with some Group 2+4+9 stacked resistant populations identified.

With the declining usefulness of herbicide control, researchers evaluated alternate, physical management strategies for controlling kochia patches. This strategy, if implemented for three years, takes advantage of the short seedbank persistence of kochia seeds of approximately two years. The objective of the three year study was to evaluate physical patch management strategies of mowing or single applications of black plastic mulch, hydro-mulch, and chaff on kochia densities.

Six farm fields with kochia patches in the rural municipality of Last Mountain Valley, SK were used in the study. Three sites were on non-compacted soils (sites 1, 3, and 4) and the other three sites (2, 5, and 6) were on compacted soils. Site 4 had pre-treatment mechanical control and Site 6 had pre-treatment chemical control.

The six treatments included an untreated control, black plastic mulch, overseeding with green wheatgrass 'AC Saltlander', field chaff, a coconut-based hydro-mulch referred to as coco mulch, and mowing using a string trimmer with clipping removal. The treatments were applied only in the spring of 2021 except for mowing which was conducted four times each year.

AC Saltlander was broadcast seeded in the spring at 10 pounds per acre (11 kg/ha), but failed to establish and was re-broadcast on November 2, 2021 at 20 lbs./ac. (22 kg/ha). Unfortunately, AC Saltlander did not establish, and effectively became a second kochia 'control' treatment.

Black plastic mulch was applied in the spring and required some repairs in 2022. Coco mulch was applied at 3,026 lbs./ac. (3,400 kg/ha). Wheat chaff at a depth of 2.75 inches (7 cm) was applied on four sites, and canola chaff on one site. Site 4 had minimal chaff availability, so cattail leaves cut six inches (15 cm) above the soil surface were applied as a chaff treatment. Mowing was conducted when kochia reached four inches (10 cm) in height.

The following variables were measured in each year: mulch depth (for chaff and coco mulch treatments); kochia density counts; soil microbiome characterization; soil chemical profile; and soil allelochemical characterization. Kochia densities were measured five times throughout the spring and summer. Soil microbiome, chemistries and allelochemical properties were analyzed from soil cores taken in late September of each year.

Warm and dry environmental conditions favoured kochia development.

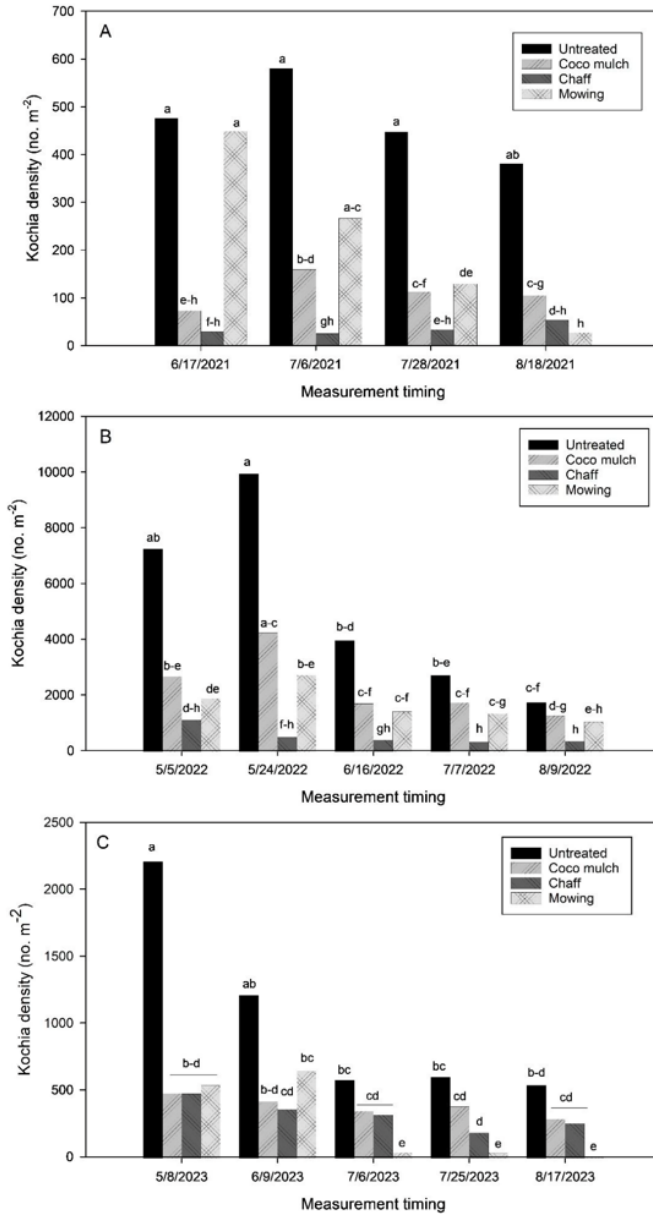
Mowing and crop mulch effective

Kochia density in the untreated control reached a maximum of 60 plants/ft² (600 plants/m²) in 2021, 1000 plants/ft² (10,000 plants/m²) in 2022, and 230 plants/ft² (2300 plants/m²) in 2023. The researchers observed that in 2022 and 2023, kochia establishment was high and there was evidence of 'self-thinning' of the stands between May and June measurements.

The black plastic mulch was the most successful in controlling kochia, so much so that kochia failed to emerge through the mulch in each treatment years. However, it had degraded by the end of 2022 and was replaced. While successful, black plastic mulch would only be suitable for non-cropped

areas. Additionally, the results showed that, unlike purple nutsedge and yellow nutsedge, kochia was unable to emerge through the plastic.

Interaction experimental treatment* and measurement timing on resultant kochia density in: A) 2021, B) 2022, and C) 2023 across six sites near Govan, SK



*The black plastic mulch treatment is not represented as kochia did not establish through it.

Source: Sharpe et al. 2025

The next most successful was the chaff treatment with the lowest kochia density in 2021 and 2022, and the second best compared to mowing at the early July measurement date in 2023. Chaff mulch reduced kochia densities to 5 to 14% of the untreated control in 2021, 5 to 22% in 2022, and 22 to 56% in 2023. The reduced kochia control in 2023 was attributed to degradation of the chaff by two-thirds of its original depth. The researchers indicated that further research should be conducted to see if heavy harrowing could help restore the chaff depth, and if field crops are able to establish and grow through the chaff.

Mowing had the lowest kochia densities in 2023. In 2021, mowing reduced kochia densities to 7% of the untreated control, and to 2% of the untreated control in 2023. In 2022, kochia plants were very short, which limited the effectiveness of the treatment with final treatment densities similar to the untreated control. The mowing treatment had several drawbacks including the need for multiple mowing in the absence of crop competition, and the patches would need to be in accessible areas of the field. Further research into the effectiveness of commercial flail mowers would help to understand if higher mowing of a few inches would be effective.

Coco mulch applied once during the spring of 2021 also helped to reduce kochia densities over the three years, but was not as effective as the other chaff treatment or mowing. In 2021, coco mulch reduced kochia densities to 16 to 28% of the untreated control, and by 37 to 73% in 2022, and 22 to 64% in 2023. Even though coco mulch formed a firm layer on the soil surface, its performance wasn't as high as expected. More research would be required to determine the effective mulch depth, but the expense would likely make its use prohibitive.

Soil allelochemicals were rarely a concern after the treatments, indicating that the treatments would not hinder post-infestation soil remediation. The diversity and composition of the soil bacterial and fungal communities were not impacted by the treatments.

Economic analysis

An economic analysis was conducted to compare the cost of the treatments. This included equipment, materials, labour, and gas. For the plastic, coco and chaff mulches, there was a one-time establishment cost. Mowing was conducted four times per year. The cost estimate used an average kochia patch size of 75 acres (30.13 ha), which was based on an herbicide resistant survey from 2019/2020 in Saskatchewan.

Black plastic mulch and coco mulch were by far the most expensive treatments, mainly because of the high material costs. Black plastic materials cost \$501,183 and coco mulch materials cost \$406,552.

Considering all costs on 75 acres over three years, mowing was the least costly at \$31,175 (\$416/ac.) followed by chaff/straw mulch bales at \$38,772 (\$517/ac.) and chaff/straw mulch collected with a chaff cart at \$80,808 (\$1077/ac.). Coco mulch came in at \$450,182 (\$6000/ac.) and plastic mulch at \$527,131 (\$7028/ac.)!

These costs are high, but a pre-harvest agricultural weed survey in 2019/20 found that herbicide resistant weeds cost Saskatchewan grain farmers \$343 million annual. The question for farmers on the Prairies is what do kochia infestations cost them, and what is it worth to control patches with alternative practices when herbicides are no longer effective.

This research was funded by the Saskatchewan Ministry of Agriculture and the Saskatchewan Wheat Development Commission

Dr. Shaun M. Sharpe, Mr. Kyle Rosvold, Mr. Leonard Chester, Ms. Shaelyn St. Jacques, Dr. Jennifer Town, Dr. Krista Gill, Dr. Wan Anastasia Chan, Miss Grace Tariro Gowera, Dr. Haben Asgedom, and Mrs. Julia Y. Leeson. Evaluation of Physical Strategies for Kochia (*Bassia scoparia*) Patch Management and Soil Remediation. *Canadian Journal of Plant Science*. **Just-IN OPEN ACCESS** <https://doi.org/10.1139/cjps-2025-0095>