



Kochia yield losses can be high

CATEGORY [weeds](#) | June 27, 2022

Yield losses caused by kochia competition are high, with mean losses reported to be 68% in grain corn, 62% in sorghum, 52% in soybean, 46% in sugar beet, 40% in silage corn, 23% in sunflower, 20% in spring wheat, 13% in canola and field pea, and 7% in oat. This research review found that these losses depended on several factors.

Kochia (*Bassia scoparia*) is rapidly becoming a problematic weed in western Canada. It can produce up to 120,000 seeds per plant, which can easily be spread by the tumbling nature of the plant at maturity. Research in western Canada found that wind can blow the tumbleweed at speeds of up to 10.8 km/h with about 90% seed loss within 1 km of its original location.

Herbicide resistant kochia has also been identified on the Prairies, with all populations considered resistant to Group 2 herbicides, the majority of populations resistant to Group 9 (glyphosate), and the confirmation of resistance to Group 4 (dicamba and fluroxypyr) herbicides. This has resulted in fewer herbicide options for effective kochia control.

Observed yield losses

On the Great Plains of North America, including the Canadian Prairies, 121 research trials have documented kochia yield losses where kochia emerged with the crop and provided season-long competition.

In grain corn, the highest reported yield loss was 95% in one study, and the mean yield loss was 68%. In Alberta, kochia populations of 7.5 to 13.5 plants/ft² (75 to 135 plants/m²) caused 40% yield loss in silage corn at two locations. A concerning trend is that in 2018 in Manitoba, 70% of kochia populations found in corn were resistant to glyphosate, suggesting that the adoption of glyphosate-resistant corn contributes to higher selection pressure for these biotypes.

Sorghum yield losses have reached up to 95% in Nebraska at kochia densities of 18.4 plants/ft² (184 plants/m²). Mean yield losses were reported at 62%.

Yield losses in soybean averaged 52%, with research in Alberta finding 60% yield loss, 23% in Montana, 68% in Kansas, and 55% in Nebraska. Again, the rapid adoption of glyphosate-resistant soybean increases selection pressure for glyphosate-resistant kochia. In a 2018 Manitoba survey, 78% of kochia populations in soybean were resistant to glyphosate.

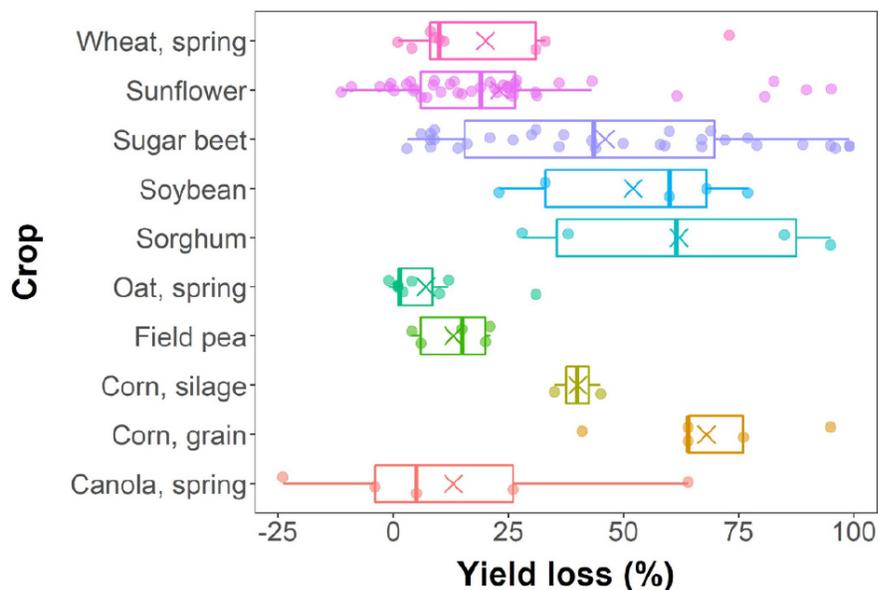


Fig. 1. Observed crop yield losses due to kochia interference. Dots indicate reported observations (treatment means) of crop yield loss, while × indicates the overall mean yield loss for each crop. The boxplot summarizes the median yield loss with first (25th percentile) and third quartiles (75th

percentile), while the boxplot tails indicate the smallest and largest values within 1.5 times the interquartile range below and above the first and third quartiles, respectively.

Source: Geddes and Sharpe. 2022

Sugar beet root yield losses averaged 46% with a range of 3 to 99% in the 29 observations at 15 environments. The highest yield losses occurred with kochia densities of approximately 4 to 6 plants/ft² (43 to 62 plants/m²). Kochia plants can quickly shade the low-growing sugar beet plants, and can result in reduced sugar beet yield. Essentially all sugar beets grown in Alberta are glyphosate-resistant, resulting in further selection pressure for glyphosate-resistant kochia, with limited other herbicide options.

Sunflower yield loss averaged 23% with 33 of the 41 observations from Manitoba. Kochia plants emerging at the same time as sunflower in Manitoba reduced sunflower leaf number, stem diameter, plant height, head diameter, seed size and seed weight.

In spring wheat, yield losses ranged from 0 to 31% in nine locations in Manitoba, Alberta and South Dakota, with an average yield loss of 20%. Group 4 herbicides have been an important control method in small grain cereals, but a 2017 survey in Alberta found that 28% of kochia populations were resistant to Group 4 herbicides – either dicamba or fluroxypyr. But recent research found only 4% overlap in resistance between the active ingredients, suggesting that rotating between these active ingredients may provide an option for control.

Canola losses averaged 13% in five environments in southern Alberta, but with a wide range of yield losses. In 2020, glyphosate-resistant canola was grown on 28% of insured canola acres on the Canadian Prairies, which means kochia will likely go uncontrolled in these acres. The wide range of yield losses warrant further investigation.

Field pea also had relatively low average yield losses at 13%. Yield losses ranged from 4 to 21% from kochia densities ranging from 8.2 to 11.9 plants/ft² (82 to 119 plants/m²). Group 2 herbicide control is no longer effective on kochia, but research has found that effective layering of Group 14 pre-emergent herbicides followed by post-emergent Group 2 imazamox + Group 6 bentazon can provide herbicidal control of Group 2+9-resistant kochia biotypes.

Oat had the lowest yield loss from kochia competition averaging 7%, with a range of -1 to 31%.

Factors influencing yield losses

Several factors determine the amount of crop yield loss caused by kochia interference. Kochia density is a driving factor, but varies by crop and environment.

Time of emergence is an important factor. Kochia emerges early, and can emerge throughout the growing season. Generally, delayed kochia emergence relative to the crop reduces competition from the kochia and yield loss. This indicates the importance of residual pre-emergent herbicides for kochia control and the maintenance of crop yields in kochia-infested fields.

The length of competition, and timing of in-crop weed control can impact yield losses. Delayed weed control results in greater early-season weed competition and increased yield loss. Research in soybean found that post emergent herbicides for kochia management at the V1 and V2 soybean growth stages resulted in higher yields than when applied at V4 and V5 growth stages.

Environment also plays an important role in kochia competition. Kochia is a C₄ plant species, and thrives in higher temperatures. It is well adapted to environments with high temperature, high erosion, low water infiltration and high disturbance.

Management of kochia will require an integrated approach, as the increase in herbicide resistance in kochia is resulting in fewer in-crop choices for herbicide control. Diversified strategies that reduce seed production and limit the return of kochia seed to the seedbank are required. These can include targeting the critical period for weed seed control, growing competitive crops, and limiting the spread of kochia tumbleweeds through spot spraying, mowing and installation or maintenance of fencing and shelterbelts. This will take a community-based approach.

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