Canadian Agronomist
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Glyphosate-resistant kochia seed loses 90% viability in less than 1 year

CATEGORY weeds | *January 23, 2020*

Time to 90% loss of glyphosate-resistant kochia seed viability averaged less than 8 months. Short seedbank longevity, delayed and reduced germination, and delayed time to first leaf of glyphosate-resistant kochia can be used to develop weed control strategies.

Kochia herbicide resistance continues to spread across the Prairies. For example, a kochia survey in southern Alberta in 2017 found that all kochia populations were resistant to Group 2 ALS inhibitors, 50% of populations were resistant to Group 9 glyphosate, and 18% of populations resistant to Group 4 (dicamba) herbicides (Beckie et al. 2019).

Viability dropped to 10% in less than one year

In this trial, the seedbank persistence of glyphosate-resistant kochia at Scott, Saskatchewan and Lethbridge, Alberta was examined. Glyphosate-resistant kochia seed was originally collected from field plots at Lethbridge, Alberta. At both sites, seed was placed on the surface of the plots and at 1 inch and 4 inches deep on October 15 in each of the two years the trial was conducted. Seed was removed from the soil at 6, 7, 8, 10, 12, 18, 20, 22, and 24 months, and then incubated on Petri plates to assess germination.

After overwintering, on April 15 six months after the experiment started, viability of glyphosate-resistant kochia was still 80 to 90%. The loss of viability of glyphosate-resistant kochia seed in the soil profile, regardless of placement, was rapid from mid- April to mid-June at both sites. Viability declined to about 40 to 50% at seven months, and time to 90% loss of viability was 228 days at Scott, and 235 days at Lethbridge.

This short seedbank longevity could be an advantage for kochia control if further kochia infestations are prevented from setting seed or entering the field by wind dispersal. However, the researchers caution that it can also be a risk factor for resistance development because of rapid kochia seedbank turnover rates.

Delayed and reduced germination and growth

To look at seed germination and early growth, two glyphosate resistant and two susceptible kochia populations from Saskatchewan and Kansas, and one glyphosate resistant and one susceptible population from Colorado were compared. Germination and early growth characteristics were investigated in the greenhouse at seven constant temperatures of 1C, 2C, 3C, 4C and 5C, and fluctuating 5C and 1C, and 9C and 1C temperatures. Over a 19-day period, time to germination and time to first leaf were determined.

Glyphosate-resistant kochia from Saskatchewan and Kansas generally germinated later (4 days) and had lower cumulative germination (28 percentage points) than glyphosate-susceptible kochia. There were no differences in the Colorado populations.

Time to 10% first leaf of glyphosate-resistant kochia tended to be later than susceptible kochia, as well (just over 2 days). Glyphosate-resistant kochia also had fewer seedlings (12 percentage points) reach the first leaf stage by the end of the experiment

These differences in germination timing and early season growth could possibly be exploited with weed management practices through delayed pre-seed weed control, or alternatively, early seed date to enhance crop competitiveness against later emerging glyphosate-resistant kochia.

Beckie, H J, Blackshaw, R E, Leeson, J Y, Stahlman, P W, Gaines, T A & Johnson, E N. (2018). Seedbank persistence, germination and early growth of glyphosate-resistant *Kochia scoparia*. *Weed Research* 58, 177– 187. https://doi.org/10.1111/wre.12294