Project Title: Glyphosate- or Auxinic-Resistant Kochia and Russian Thistle Prairie Surveys
Category: Agronomy

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Status: Completed

SaskCanola Investment: $20,000

Total Project Cost: $87,800

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Grower Benefits:
-Kochia is a prolific seed producer so best management practices that limit biomass and reduce the soil seedbank by limiting seed return are advisable
-Crops such as spring oats, field pea, canola and spring wheat are among the most tolerant to kochia interference
-In Saskatchewan, glyphosate resistant kochia was found in 87% of samples and dicamba resistant kochia was found in 45% of samples. Assuming all kochia is resistant to ALS-inhibitors (Group 2), triple resistant kochia was found in 40% of Saskatchewan samples.

Project Summary:

Kochia is a problem weed in Prairie field crops which reduces crop yield and impedes harvest. Kochia is mainly managed with herbicides and has become resistant to several. Herbicide-resistant kochia will survive and reproduce when sprayed with a herbicide which normally kills it. The study objective was to survey glyphosate-resistant and dicamba-resistant kochia within Manitoba in 2018, Saskatchewan in 2019, and Alberta in 2021. Kochia seed was collected at approximately 300 sites in each province. Samples were threshed and seeded in the greenhouse then sprayed with labeled doses of glyphosate or dicamba then evaluated after 3 or 4 weeks, respectively.

The occurrence of glyphosate-resistant kochia has increased from previous surveys, found in 58% of Manitoba sites, 87% of Saskatchewan sites, and 78% of Alberta sites. Dicamba-resistant kochia was found at 1% of Manitoba sites, 45% of Saskatchewan sites, and 28% of Alberta sites. This documents the first instance of dicamba-resistant kochia in Manitoba. Previous surveys have shown that all kochia is resistant to ALS-inhibitors (Group 2) so triple-resistant kochia was present in 40% of Saskatchewan samples, <1%

of Manitoba sites, and 10% of Alberta sites. Additional screening showed 44% of Alberta sites were fluroxypyr-resistant and 25% were triple-resistant.

Herbicide-resistant kochia has become widely distributed on the Prairies. Best management practices (BMPs) for controlling herbicide-resistant kochia are grouped into four categories: A) the premise BMP, B) knowledge BMPs, C) control BMPs, and D) space-time BMPs. The premise BMP is to reduce the soil seedbank. The soil seedbank is the collection of all weed seed and plant parts found in the soil from year to year. Each year, kochia emerges from the seedbank to compete with the crop. The seedbank should be kept static or declining by stopping seed from going back into the soil. Reducing the seedbank reduces how many plants may emerge and need to be killed by any given herbicide at any given time.

The knowledge BMPs include scouting routinely and understanding weed biology. Scouting will be critical; a GPS can be used to map patch size over time to evaluate how effective management strategies were. Kochia is drought tolerant, its seed is dispersed with wind, and its seed is short lived in the soil. Intensive management may help reduce seedbanks as the seed decays in the soil, but wind and drought may lead to new patches or reestablish older ones through tumbleweeds.

The control BMPs include: 1) use a diversified approach, 2) use full labeled herbicide doses to the proper stage, 3) rotate modes of action, 4) use cultural practices to achieve canopy closure rapidly, and 5) use mechanical control strategies when possible. A diversified approach incorporates many management strategies including cultural, chemical, and mechanical control. The aim is to reduce how many weeds a herbicide must kill at any time by incorporating non-chemical control strategies into management programs.

A herbicide mode of action is the specific internal way which the herbicide kills the plant and are found on each herbicide label. Multiple, effective modes of action on kochia should be incorporated into management strategies through layering, tank-mixing, sequential applications, and rotating between years. Using different modes of action will kill kochia different ways, making it more challenging to overcome any one herbicide. The full herbicide dose should be applied to the proper kochia size, which varies by herbicide label so please consult each label prior to use. Lower doses may not kill kochia entirely and survivors may develop resistance.

Cultural methods should aim to achieve canopy closure of the crop. The main principle is to have the crop use the available space to intercept sunlight (among other resources) so it is unavailable to kochia. Cultural strategies include using competitive cultivars, increased seeding rates, and narrow row spacing. Crop rotation is another cultural method which uses alternative types of crops to compete against kochia. Crops may be rotated by crop type (broadleaves vs grasses) or by life cycle (spring annual vs winter annual vs perennial). Rotations may also permit access to additional herbicide modes of action. Mowing is a physical control strategy that could be used earlier in the season to prevent reproduction if yield loss is unavoidable where kochia infests.

The space-time BMPs include: 1) managing weeds prior to seeding, 2) managing weeds at or after harvest, 3) preventing within and between field movement of kochia seed and tumbleweeds, and 4) managing field borders. Pre-seed herbicide burn-down and spot tillage may be used prior to seeding to manage emerged kochia. Seed destructor mills for combines are available on the Prairies, have shown to destroy kochia seed, but longer-term control requires further study. Depositing chaff on marginal kochia patches may help limit emergence and move weed seed found in chaff out of the field. Sanitation of seeders and combines is critical to prevent introducing herbicide-resistant kochia seed across and between fields. If possible, establish a perennial grass in ditches and marginal land so kochia has fewer places to tumble and establish. Kochia can be found in non-cropped areas such as field approaches, sloughs, margins, grain bins, railways, and oilwells among others. Kochia control in these areas is important as these escaping tumbleweeds will make long-term management challenging as they are taken by the wind into farmland.

Link to Final Report: PDF attachment

Other Acknowledgements of this Research Project: