**Introduction and Objectives**

Herbicide-resistant (HR) weeds are a growing concern for farmers worldwide, and Manitoba is no exception. The percentage of annual-cropped fields occupied by HR weeds in Manitoba increased from 32% in 2002 to 48% in 2008 to 68% in 2016. The most-recent Manitoba survey (2016) estimated that HR weeds cost Manitoba farmers about $73 million annually in reduced crop yields and quality and increased weed control expenses. Continued monitoring of the occurrence, distribution and impact of HR weeds is essential to understand how best to mitigate and manage this increasing threat to cropping systems. The objective of this study was to determine the occurrence, distribution, and impact of HR weeds in Manitoba in 2022, with particular focus on tier 1 acetyl-CoA carboxylase (ACCase) and acetolactate synthase (ALS)-inhibiting herbicides.

**Materials and Methods**

- Randomized-stratified pre-harvest survey conducted in mid- to late-August of 2022.
- 155 randomly-selected ¼ sections (65 ha) (Fig. 1) stratified based on cultivated area within each ecoregion and seeded area of each crop (Table 1).
- Mature weed seeds collected from uncontrolled visible weed patches, and the patch area estimated.
- Seeded in 24×24.5 cm flats with soilless medium and watered daily in the greenhouse.
- 16 hr photoperiod with 20/18°C temperature and 230 µmol m⁻² s⁻¹ supplemental light.
- Tested with 1 ACCase- and ALS-inhibiting (Groups 1 & 2) herbicides (Table 2).
- Herbicides applied at the 2-4 leaf stage using a move-nozzle cabinet sprayer (TeeJet® 8002VS nozzle; 275 kPa; 200 L ha⁻¹ solution; 2.4 km hr⁻¹).
- Plants characterized as resistant (no injury; injury with new growth) or susceptible (dead; nearly dead) 3 wk after treatment relative to resistant and susceptible controls.
- Maps of resistance occurrence developed using QGIS v. 3.22.

**Results**

- 1,037 tests were conducted on 576 samples, representing 35 weed species.
- 75% of the fields were occupied by HR weeds in 2022 (Table 3; Fig. 2).
- The estimated area occupied by HR weed patches decreased from 2.2 million ha in 2016 to 1.4 million ha in 2022, while the equivalent field area increased from 2.7 million ha in 2016 to 3.0 million ha in 2022 (Table 3).
- Based on previous grower estimates combined with the area where HR weeds were present before crop harvest in Manitoba in 2022 (Table 3), HR weeds cost Manitoba farmers about $81 million annually.
- New issues of concern that warrant further investigation include (Table 3; Fig. 3):
  - Putative ACCase inhibitor-resistant barnyardgrass, quackgrass, and stinkgrass.
  - Putative ALS inhibitor-resistant quackgrass, spiny sowthistle, lambquarters, and horsetail.
- This survey did not test for glyphosate or auxinic herbicide resistance in kochia due to limited mature seed present pre-harvest. However, the 2018 post-harvest survey of Manitoba documented glyphosate and dicamba resistance in 50% and 1% of the kochia populations sampled, respectively.
- Extreme precipitation causing flooding during the spring of 2022 and late seeding of crops. Late weed recruitment likely altered the weed communities present.

**Conclusions**

Overall, 75% of the sampled fields in Manitoba had at least one HR weed biotype present before crop harvest. HR weeds occupied 1.4 million ha of cropland in 2022, equivalent to a field area of 3.0 million ha. HR weeds cost Manitoba farmers an estimated $81 million annually in increased weed control expenses and reduced crop yields and quality. The growing impact of HR weeds warrants greater investment in integrated weed management programs.

**References**


**Acknowledgments**

We sincerely acknowledge the technical assistance of Shane Hilladan. We also thank Hugh Beckie for sharing his vast experience in herbicide resistance diagnostics.