



Status of Weed Surveillance Efforts in Manitoba

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WEED SURVEYS HELP us understand changes in weed populations both geographically and over time. These surveys represent a huge collaborative effort between Manitoba Agriculture and Agriculture and Agri-Food Canada (AAFC) research scientists. Below summarizes the recent results of the weed abundance survey led by Julia Leeson, AAFC-Saskatoon and Kim Brown-Livingston, Manitoba Agriculture and the herbicide-resistant weeds survey led by Charles Geddes, AAFC-Lethbridge.

WEED ABUNDANCE SURVEY

The sixth weed abundance survey was conducted in Manitoba in 2022. Among 704 fields surveyed, 64 soybeans, 30 pea and 26 dry bean (specifically pinto bean) fields were surveyed. This was the first time that peas and dry beans have been included.

Fields were randomly selected and sampled. Fields were surveyed between late July to the end of August to capture the extent of troublesome weeds that escaped control measures. At 20 locations within each field, weeds were identified and counted within a 0.25 m² quadrat.

Of all crops surveyed, green foxtail remained the number one most abundant weed in Manitoba. It's consistently held that spot since the 1970s. It was followed by wild buckwheat, volunteer canola, lambsquarters and redroot pigweed. Compared to the previous survey, lambsquarters, redroot pigweed, yellow foxtail and kochia have been increasing over time while wild oats and Canada thistle have decreased.

Volunteer canola was the most abundant weed in soybeans and peas, escaping control in 42 per cent and 68 per cent of



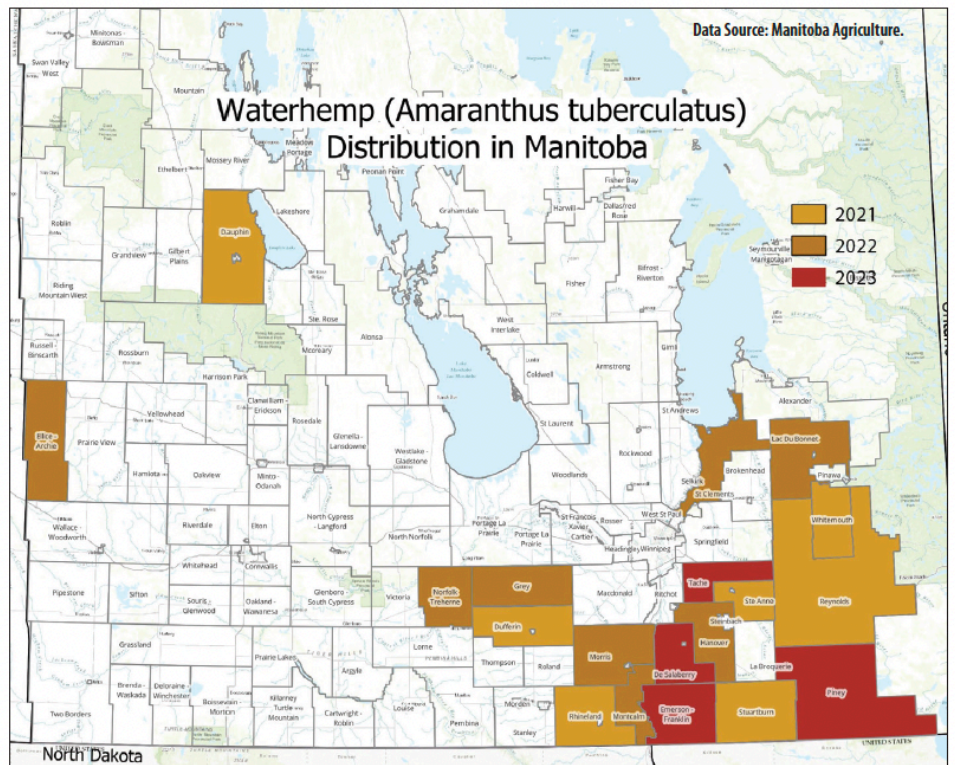
Young kochia plants next to peas at V4 (four true leaf nodes).

Photo credit: Laura Schmidt

fields, respectively, while redroot pigweed was the most common weed in pinto beans, infesting 35 per cent of fields at the end of the season. Table 1 lists the top 10 most abundant weeds (based on frequency, field density and field uniformity) for the soybean, pea and dry bean crops surveyed in 2022. Among soybean and pulse crops, the top five most troublesome weeds were volunteer canola, wild buckwheat, green foxtail, redroot pigweed and lambsquarters. This is consistent with the overall view of



Photo credit: Laura Schmidt



Left, Figure 1. Rural municipalities in Manitoba where waterhemp has been found, coloured by the year it was first identified in the area.

Above, Figure 2. Rural municipalities in Manitoba where waterhemp has been found, coloured by the year it was first identified in the area.

Table 1. Top 10 most abundant weeds in 2022 across Manitoba in soybean, pea and dry bean crops.

Rank ¹	Soybeans (64 fields)			Peas (30 fields)			Dry Beans (Pintos - 26 fields)		
	Weed	% of Fields	Field Density ² (weeds/m ²)	Weed	% of Fields	Field Density ² (weeds/m ²)	Weed	% of Fields	Field Density ² (weeds/m ²)
#1	Canola	42	3.9	Canola	68	6.6	Redroot pigweed	35	0.9
#2	Wild buckwheat	39	2.1	Green foxtail	52	7.1	White mustard	8	2.8
#3	Green foxtail	27	1.9	Wild buckwheat	39	11.4	Lambsquarters	22	0.4
#4	Round-leaved mallow	15	1.9	Wheat	22	3.0	Green pigweed	12	1.1
#5	Lambsquarters	14	1.0	Black medick	26	1.8	Green foxtail	7	1.0
#6	Ryegrass spp.	1	30.8	Lambsquarters	27	1.7	Canola	8	0.5
#7	Broad-leaved Plantain	8	2.7	Foxtail barley	12	11.8	Round-leaved mallow	4	1.8
#8	Wheat	8	2.2	Round-leaved mallow	18	2.1	Wheat	7	0.6
#9	Redroot pigweed	7	1.4	Canada thistle	25	0.7	Wild buckwheat	7	0.3
#10	Biennial wormwood	9	0.9	Night-flowering catchfly	7	10.7	Wild mustard	8	0.2

¹Ranked based on relative abundance (field frequency and the occurrence/density within the field).

²Field density is a measure of the number of plants of each species counted in a square meter in fields where the weed occurred.

tough-to-manage weeds in all of the crops surveyed in Manitoba.

GROUP 1 AND 2 HERBICIDE-RESISTANT SURVEY

A subset of 155 fields was also surveyed for Group 1 and 2 herbicide-resistant weeds in 2022 (Table 2). All visible weeds with mature seeds were collected prior to harvest for assessment in the greenhouse.

Overall, 75 per cent of fields surveyed had herbicide-resistant weeds in 2022. This is a continued increase compared to 68 per cent in 2016 and 48 per cent in 2008. The most common herbicide-resistant weed was wild oats, found in 37 per cent of fields. All wild oats tested were resistant to Group 1 and 82 per cent were also resistant to Group 2.

Kochia was the most common resistant broadleaf weed, occurring in 19 per cent of fields overall. At this point, all kochia populations are assumed to be resistant to Group 2 herbicides. Due to the timing of this survey in late August, there's limited amount of mature kochia seed to be collected. As a result, this survey is unable to test for glyphosate or Group 4 resistance in kochia.

New Group 1 and 2 resistance issues of concern identified in this survey for further

investigation include presumed Group 1-resistant barnyardgrass, quackgrass and stinkgrass as well as presumed Group 2-resistant quackgrass, spiny sowthistle, lambsquarters and Canada fleabane.

Based on this survey, an estimated 7.4 million acres of cropland were infested with an herbicide-resistant weed based on field area, representing an estimated increase in yield losses and weed control costs of roughly 81 million dollars each year for farmers in Manitoba.

CASES OF HERBICIDE RESISTANCE TO OTHER MODES OF ACTION

While the previous survey documents Group 1 and 2 resistance, other cases of herbicide resistance are known to occur in Manitoba (Table 3). We can also look to our neighbours, North Dakota and Saskatchewan, for other cases of herbicide resistance that may be on our future (included in grey).

Glyphosate-resistant kochia has been an ever-increasing problem since it was first reported. As of 2021, 74 per cent of kochia surveyed across the Canadian Prairies was confirmed to be resistant to glyphosate. In Manitoba, with our greater frequency of

growing Roundup Ready soybeans, corn and canola in rotation, we can expect that this number will quickly increase further.

In terms of Group 4-resistant kochia, that term is an over-generalization. Kochia populations in Manitoba have specifically been confirmed to be resistant to dicamba. For the most part, other Group 4 herbicides like fluroxypyr can still have efficacy on these dicamba-resistant kochia populations. However, fluroxypyr-resistant kochia has been reported in the other Western provinces and may develop here. In 2018, only one per cent of kochia populations in Manitoba had dicamba resistance.

On the horizon for kochia is Group 14 resistance found in Saskatchewan in 2021 and North Dakota in 2022, as well as Group 5 resistance which occurs throughout the United States. Of particular note in our soybean and pulse crops is the potential of losing Group 14 efficacy – we rely fairly heavily on that mode of action due to limited in-crop herbicide options. Charles Geddes, a weed scientist at Agriculture and Agri-food Canada Lethbridge and his lab are investigating populations of Group 14

Table 2. Weeds resistant to Group 1 and 2 herbicides that are known to occur in Manitoba or surrounding areas (coloured in grey) and their frequency in the 2022 Group 1 and 2 herbicide-resistant weed survey.

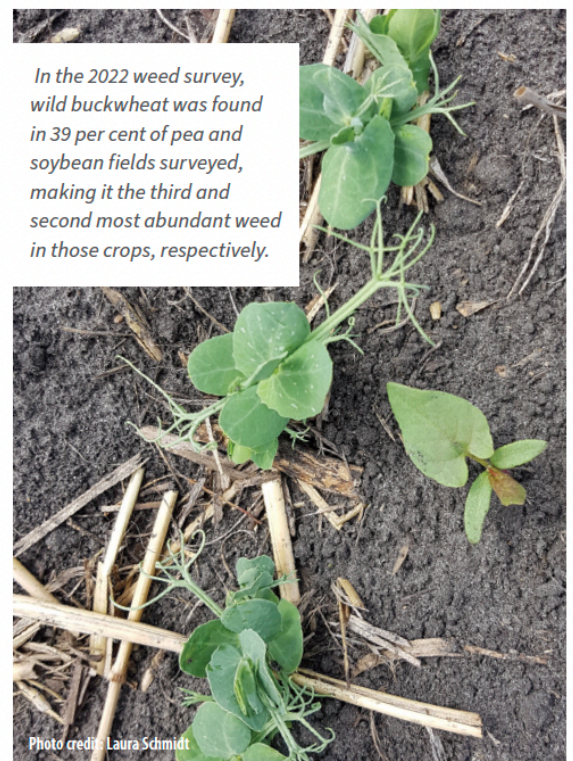
Herbicide Group (mode of action)	Resistant Weed	% fields with HR weed detected ² (2022 MB unless otherwise noted)
Group 1 (ACCase inhibitors like <i>Puma, Achieve</i> , etc.)	Wild oat ¹	37%
	Green foxtail ¹	27%
	Yellow foxtail ²	12%
	Barnyardgrass ²	11%
	Stinkgrass ²	3%
	Quackgrass ²	1%
Group 2 (ALS inhibitors like <i>Solo, Refine, Pursuit</i> , etc.)	Wild oats ¹	30%
	Barnyardgrass ²	29%
	Yellow foxtail ²	3%
	Quackgrass ²	1%
	Green foxtail ²	<1%
	Kochia ¹	19%
	Redroot pigweed ¹	13%
	Powell's amaranth ¹	13%
	Pale smartweed ¹	10%
	Spiny sowthistle ²	7%
	Lambsquarters ²	4%
	Wild mustard ¹	3% (SK)
	Stinkweed ¹	2% (SK)
	Shepherd's purse ²	1%
	Cleavers ¹	1%
	Canada fleabane ²	1%
	Hempnettle ¹	1% (SK)
	Chickweed ¹	<1%
	Waterhemp ⁴	-
	Eastern black nightshade ³ (ND)	-
Marshelder ³ (ND)	-	
Ragweed ³ (ND)	-	
Palmer amaranth ³ (ND)	-	
Russian thistle ² (SK)	4% (SK)	

¹Weedsience.org

²Geddes et al. 2024

³2024 ND Weed Control Guide pg. 96

⁴Personal communications



Right: Lambsquarters in mid-May.

Table 3. Other known cases of herbicide-resistant weeds in Manitoba and North Dakota (coloured in grey).

Herbicide Group (mode of action)	Resistant Weed
Group 3 (Mitotic inhibitors like <i>Edge</i> , <i>Treflan</i>)	Green foxtail ¹
	Redroot pigweed ⁴
Group 4 (Growth regulators like dicamba, 2,4-D or fluroxypyr, etc.)	Wild mustard ¹
	Kochia ²
	Waterhemp ³ (ND)
Group 5 (PSII inhibitors like <i>Sencor</i> , atrazine, etc.)	Wild mustard ¹
	Kochia ³ (ND)
	Palmer amaranth ³ (ND)
Group 9 (EPSPS inhibitor - Glyphosate)	Kochia ¹
	Waterhemp ⁴
	Canada fleabane ³ (ND)
	Common ragweed ³ (ND)
	Palmer amaranth ³ (ND)
Group 14 (PPO inhibitors like <i>Heat</i> , <i>Aim</i> , <i>Reflex</i> , <i>Authority</i> , etc.)	Wild oats ^{1*}
	Waterhemp ⁴
	Kochia (ND ³ and SK ⁴)
	Ragweed ³ (ND)
Group 15 (VLCFA inhibitors like <i>Avadex</i> , <i>Zidua</i> , etc.)	Wild oats ¹

*Wild oat resistance to Gr 14 herbicides was tested using Authority, which is not a product registered to control wild oat.

¹Weedscience.org,

²Geddes et al. 2024,

³2024 ND Weed Control Guide pg. 96,

⁴Personal communications



Photo credit: Laura Schmidt



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Top: Volunteer canola was the most abundant weed in soybeans and peas in 2022, infesting 42 per cent and 68 per cent of fields, respectively.

Middle: Young kochia plants next to soybeans at the VC (unifoliolate) stage.

Bottom: Kochia trails through a field of Roundup Ready soybeans. Of kochia populations collected from Manitoba in 2018, 58 per cent were glyphosate resistant, one per cent were resistant to dicamba and it's assumed all were resistant to Group 2 herbicides.

Tall waterhemp from a soybean field with a close-up of the flower panicle (A) and the smooth stem (B), a key characteristic of identification.



resistant kochia further to assess if there's broad cross-resistance to active ingredients within the Group 14 herbicides.

Waterhemp is currently a Tier 1 noxious weed in Manitoba and plants must be destroyed if discovered. Of those populations that have popped up in Manitoba (Figure 1) and been sent for testing, resistance to Group 2, 9 and 14 has been documented. These seeds are expected to have come into the province in many cases on Red River floodwaters, meaning we may also be seeing North Dakota's waterhemp resistance to Group 4 sometime soon.

If you're not already, it's time to start considering alternative, non-herbicidal methods of weed control on your farm and incorporating an integrated weed management strategy. We're not spraying our way out of these resistance issues. ■

References

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Geddes et al. 2023. Manitoba survey of herbicide-resistant weeds in 2022.

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