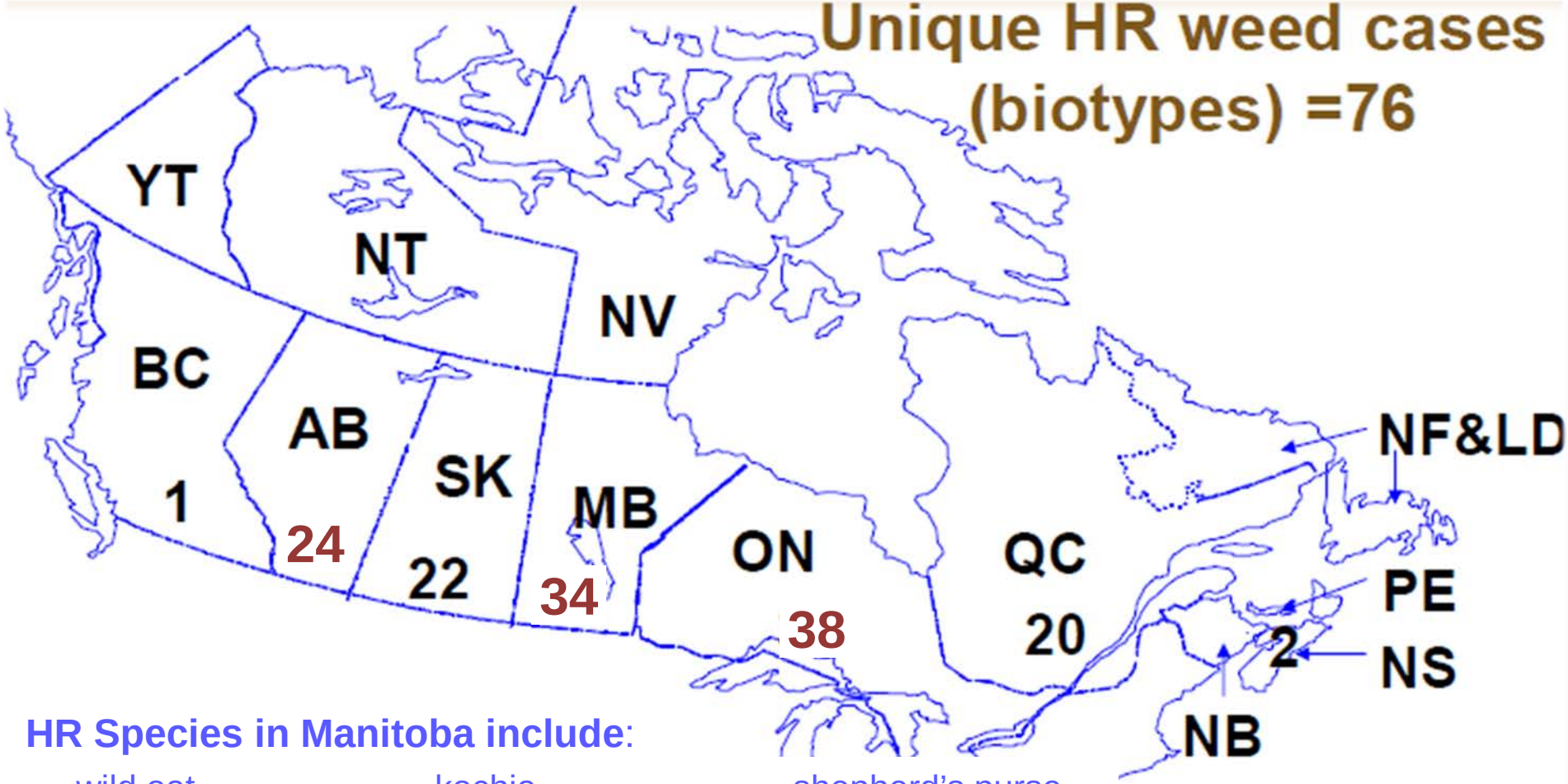
Losing the Weed Battle Could Mean Losing the Farm

Tammy Jones
Weeds Specialist,
Manitoba Agriculture and Resource Development

Ag Days
January 23rd, 2020

Manitoba

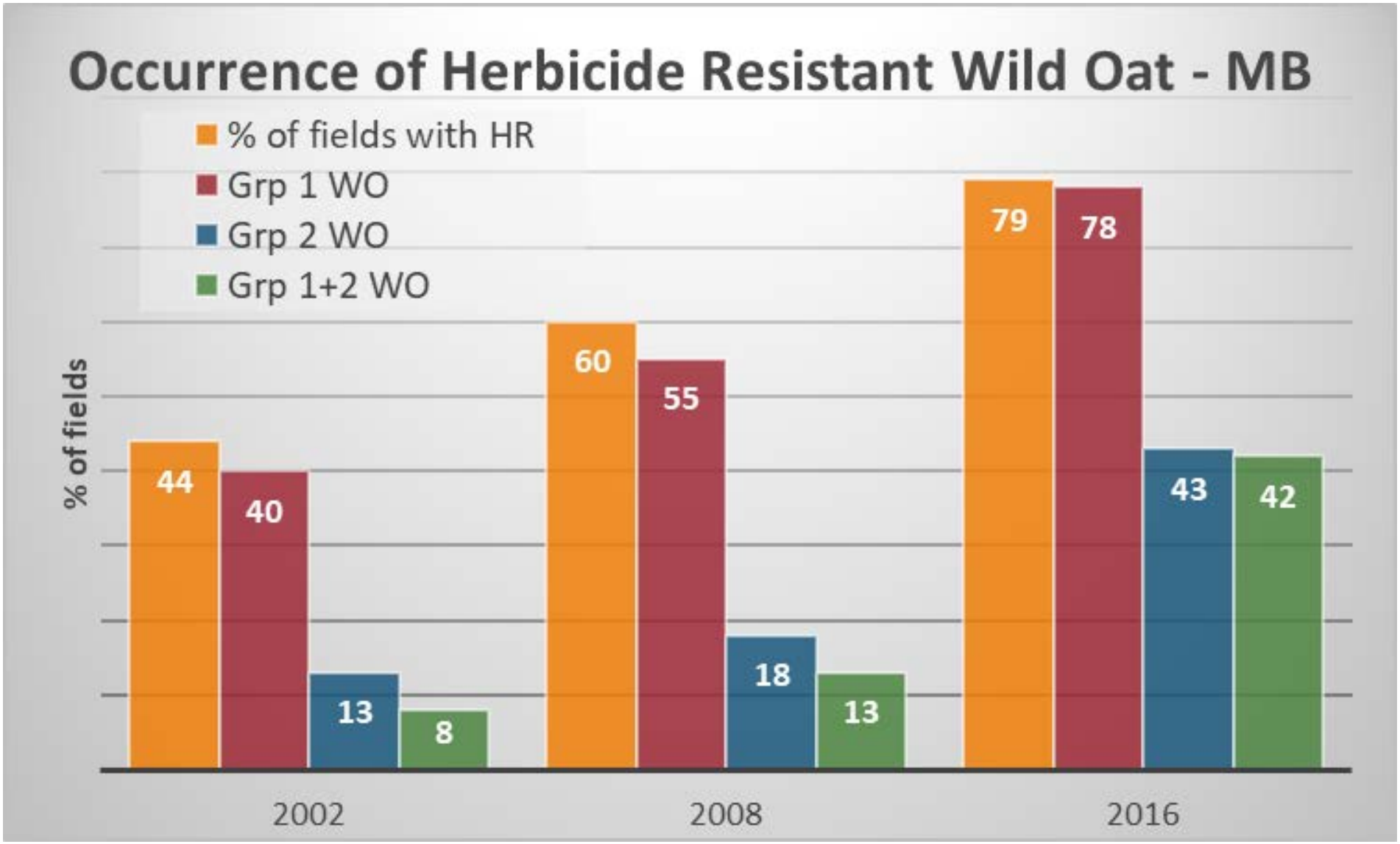
Herbicide Resistance in Canada



HR Species in Manitoba include:

- wild oat
- g & y foxtail
- barnyard grass
- wild mustard
- kochia
- chickweed
- cleavers
- hempnettle
- shepherd's purse
- stinkweed
- pigweeds

Hugh Beckie, 2018



- 150 fields across Manitoba
- 84 fields had wild oat

- 300 fields across Manitoba
- 198 fields had wild oat

- 151 fields across Manitoba
- 101 fields had wild oat

…but I don’t have a problem with wild oat

- low seed production
- self-pollinated
- no dispersal mechanism
- seedbank longevity

Wild Oat Control Options in Wheat

Manitoba

HERBICIDE	Wild Oat	WO HERB GROUP
Altitude FX2[6]	•	2
Avadex	•	8
Axial	•	1
Axial iPak	•	1
Axial Xtreme	•	1
Broadband	•	1
Clodinafop	•	1
Fenoxaprop	•	1
Flucarbazone	•	2
Focus[10]	S	14, 15
Fortress MicroActiv	•	3,8
Imazamethabenz	•	2
Olympus	S	2
Predicade	•	2
Rexade	•	2
Rezuvant	•	1
Signal SFU	•	1
Simplicity OD/ Simplicity GoDRI	•	2
Tandem	•	2
Tralkoxydim	•	1
Traxos	•	1,1
TraxosTwo	•	1,1
Tundra	•	1
Varro	•	2
Velocity m3	•	2

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Altitude FX2[6]	•	2
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Velocity m3	•	2

HERBICIDE	Wild Oat	WO HERB GROUP
Avadex	•	8
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Wild Oat Control Options in Canola

Manitoba

HERBICIDE
Ares
Avadex
Clethodim
Edge Granular
Fortress MicroAct
Glufosinate 150 (1
Glyphosate
Glyphosate+Clopy
Imazamox
Imazamox/imazet
Odyssey Ultra
Poast Ultra
Quizalofop
Salute
Solo Ultra
Tensile
Trifluralin

GROUP G/9 RESISTANT WILD OAT
(*Avena fatua*)

EPSP synthase inhibitors (G/9)

Australia, Queensland

Case Details | Similar Cases Globally | Papers for Similar Cases

INTRODUCTION

Wild Oat (*Avena fatua*) is a monocot weed in the Poaceae family. In Queensland this weed first evolved resistance to Group G/9 herbicides in 2018 and infests Chickpea. Group G/9 herbicides are known as EPSP synthase inhibitors (Inhibition of EPSP synthase). Research has shown that these particular biotypes are resistant to glyphosate and they may be cross-resistant to other Group G/9 herbicides.

The 'Group' letters/numbers that you see throughout this web site refer to the classification of herbicides by their site of action. To see a full list of herbicides and HRAC herbicide classifications click here.

WILD OAT

QUIK STATS (last updated Jan 22, 2020)

Common Name	**Wild Oat**
Species	*Avena fatua*
Group	EPSP synthase inhibitors (**G/9**)

Wild Oat Control Options in Canola

Manitoba

HERBICIDE	Wild Oat	WO HERB GROUP
Ares	•	2
Avadex	•	8
Clethodim	•	1
Edge Granular	S	3
Fortress MicroActiv	•	3/8
Glufosinate 150 (1.35L/ac)	•	10
Glyphosate	•	9
Glyphosate+Clopyralid	•	9/4
Imazamox	•	2
Imazamox/imazethapyr	•	2
Odyssey Ultra	•	1/2
Poast Ultra	•	1
Quizalofop	•	1
Salute	•	2/4
Solo Ultra	•	1/2
Tensile	•	2/4
Trifluralin	S	3

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Fortress MicroActiv	•	3/8
Glufosinate 150 (1.35L/ac)	•	10
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Solo Ultra	•	1/2
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HERBICIDE	Wild Oat	WO HERB GROUP
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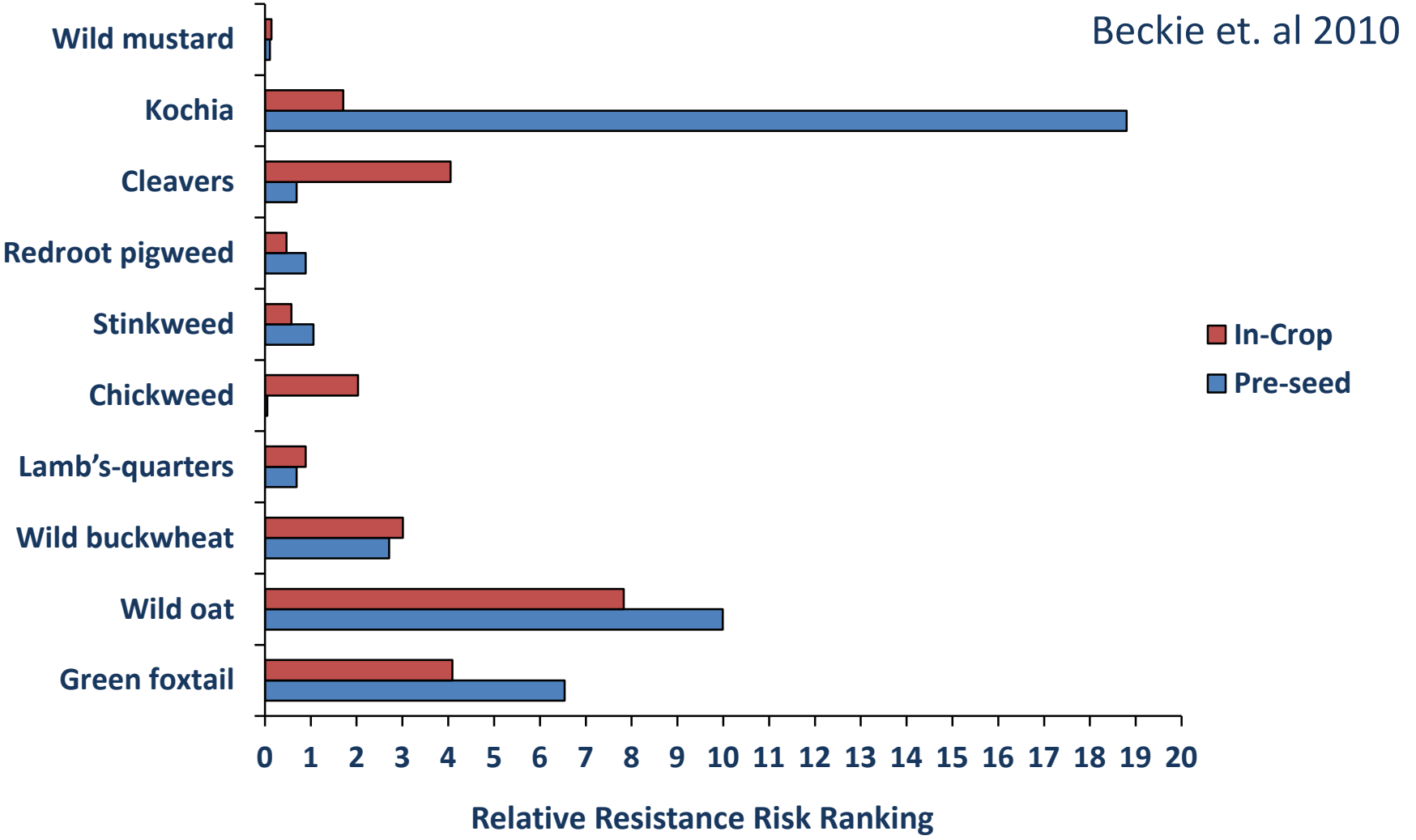
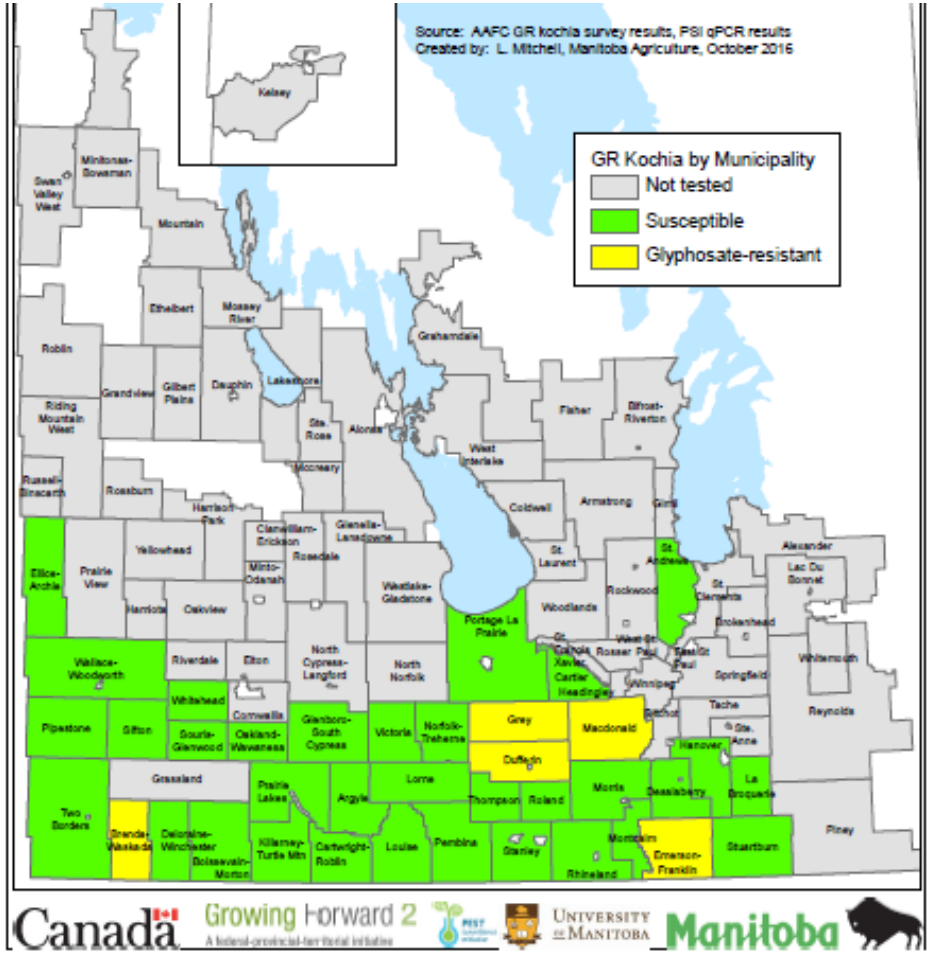
Glyphosate-Resistant Wild Oat?



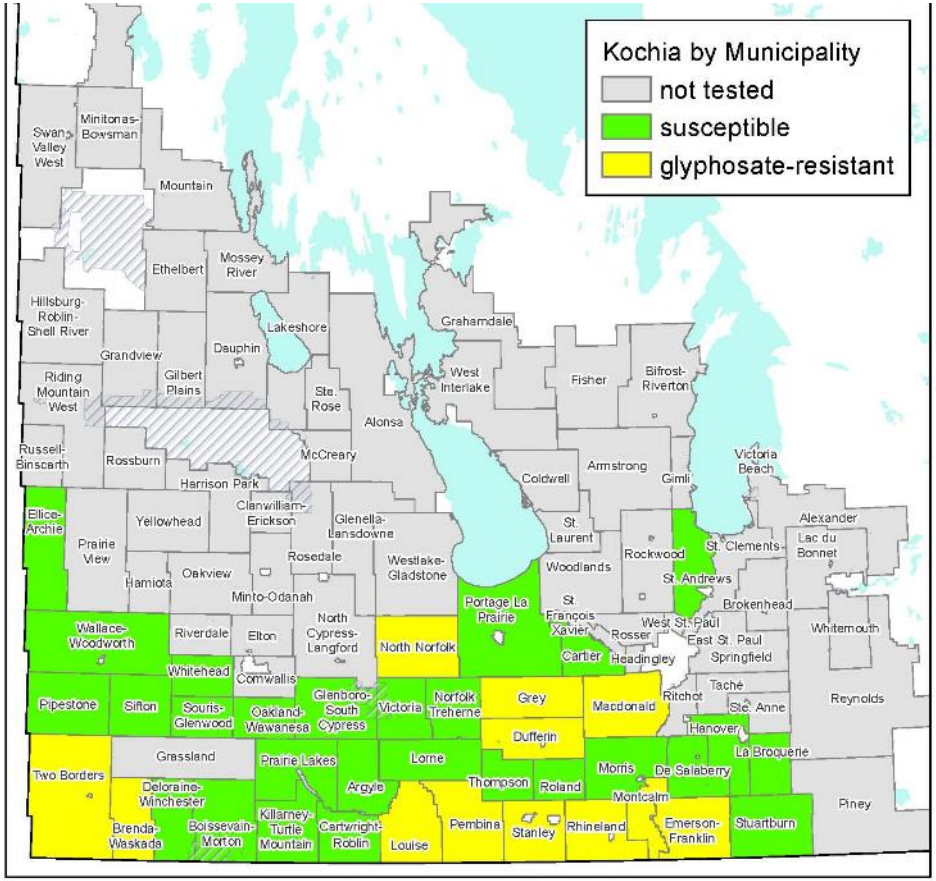
2018 Weed of the Year

Occurrence of Glyphosate Resistant Kochia - MB

2016



2018



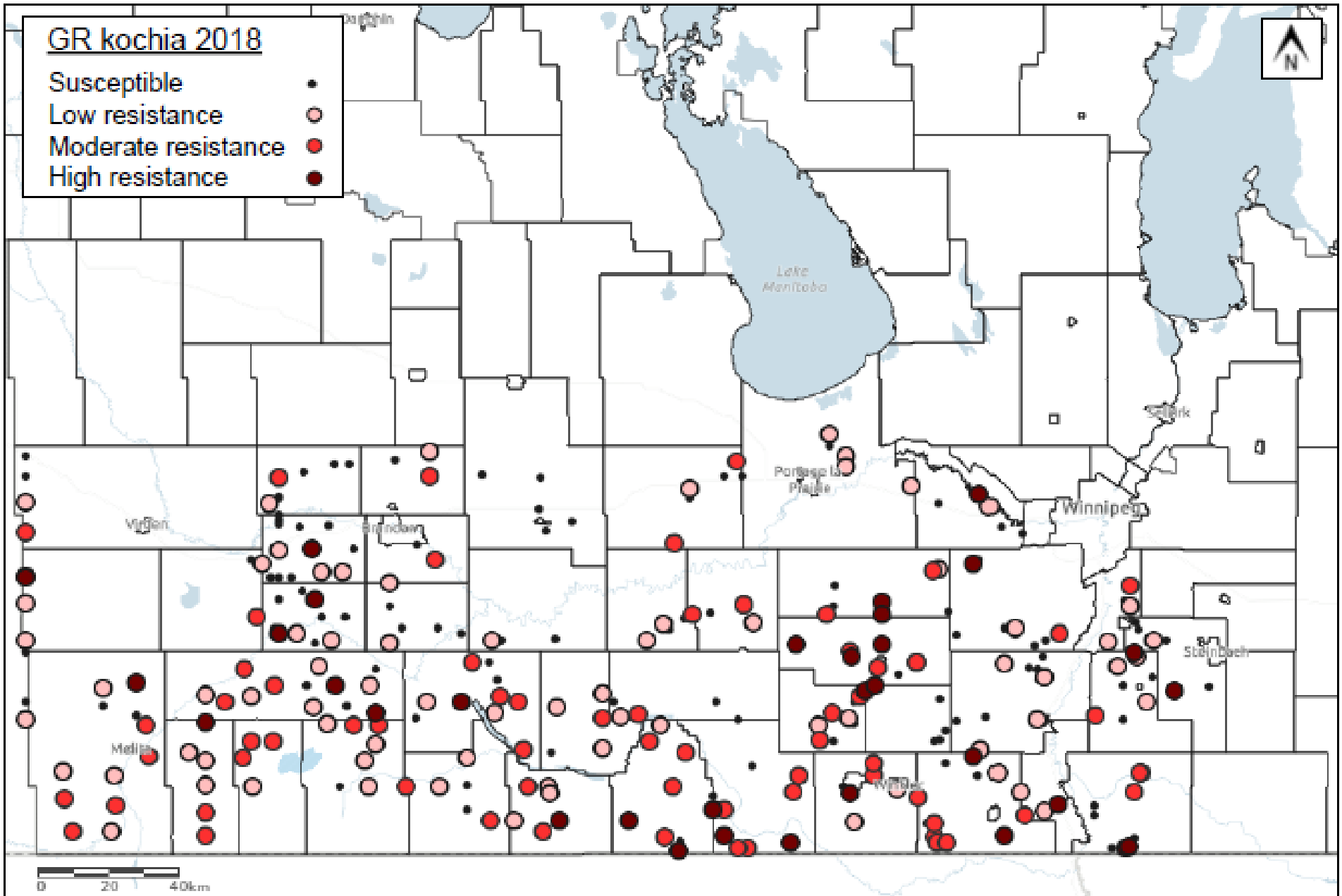
Author: Les Mitchell
Date: November 16, 2018
Source: AAFC GR kochia survey, PSI qPCR results

Occurrence of Glyphosate Resistant Kochia - AB

- In 2017, 305 randomly predetermined sites in 16 Alberta counties and municipal districts, were sampled post-harvest, in September and October
  - Glyphosate resistant kochia was found in 15 of the 16 municipalities
  - 100% were resistant to ALS inhibitors (Group 2 herbicides)
  - 50% were resistant to glyphosate (Group 9)
  - 8% were dicamba resistant (Group 4)
  - 10% of the samples were resistant to ***all three*** herbicide groups
- In 2018, 300 sites in Manitoba were collected for the same type of testing…

Occurrence of Glyphosate Resistant Kochia - MB

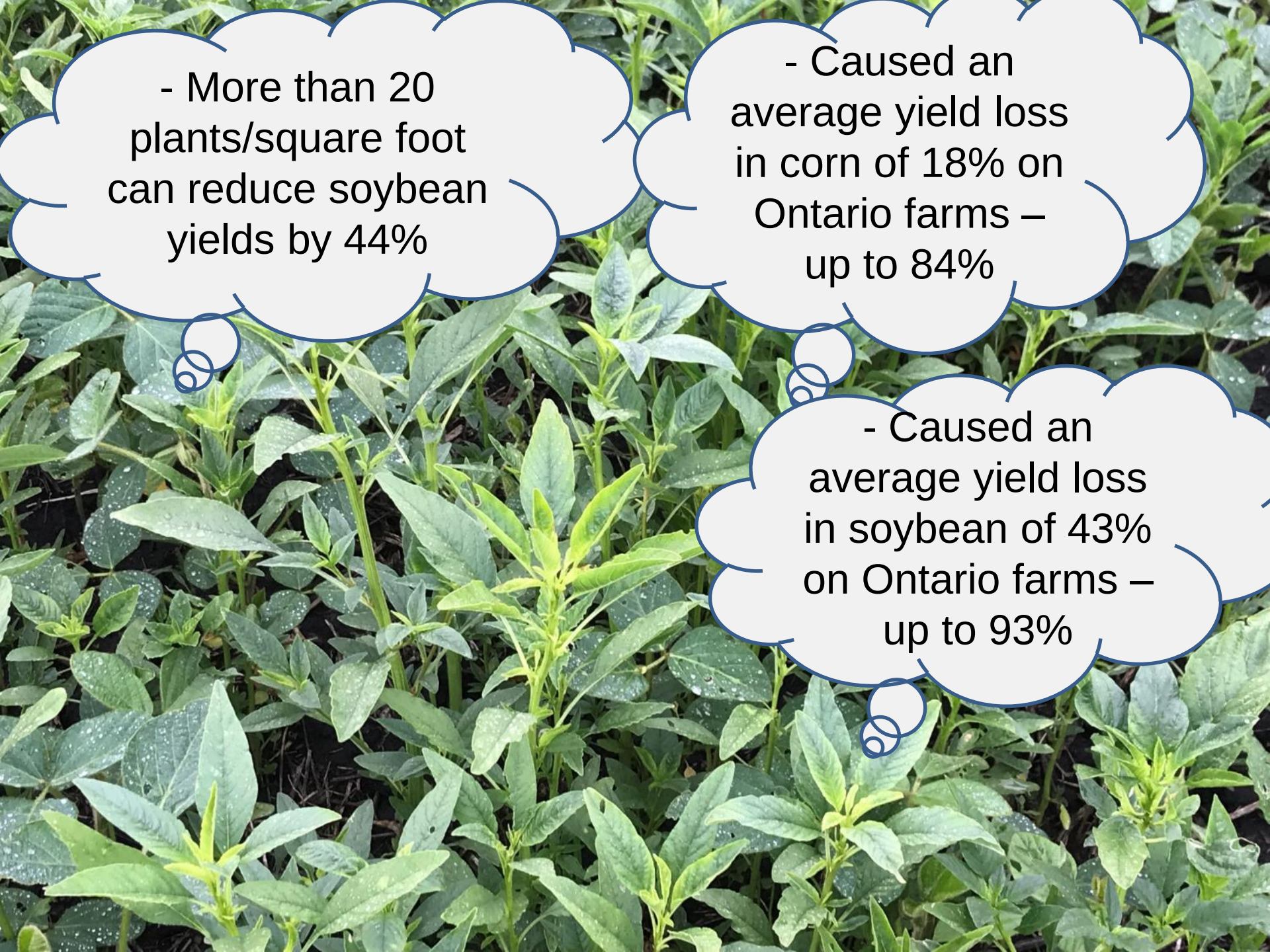
- 2013 baseline survey
  - 1% of kochia populations were GR : corn and soybean fields
- 2018 – 297 sites sampled
  - 59% of kochia populations GR : confirmed in a range of field crops, including soybean (77% of kochia populations), corn (70%), canola (53%), other oilseeds (83%), small-grain cereals (48%), pulses (20%), alfalfa/grass (50%), and ruderal areas (21%).
- Growers will need to shift their kochia management programs to compensate for the lack of efficacy of this important herbicide – Charles Geddes et al.
  - increased reliance on alternative herbicide sites-of-action pre-emergence
  - adoption of herbicide-resistant crops with stacked resistance traits
  - integration of non-chemical tools into current weed control programs.


GR kochia 2018
Susceptible
Low resistance
Moderate resistance
High resistance
Lake Manitoba
Winnipeg
Virden
Brandon
Melita
Steinbach
0
20
40km

2019 Weed of the Year - Waterhemp

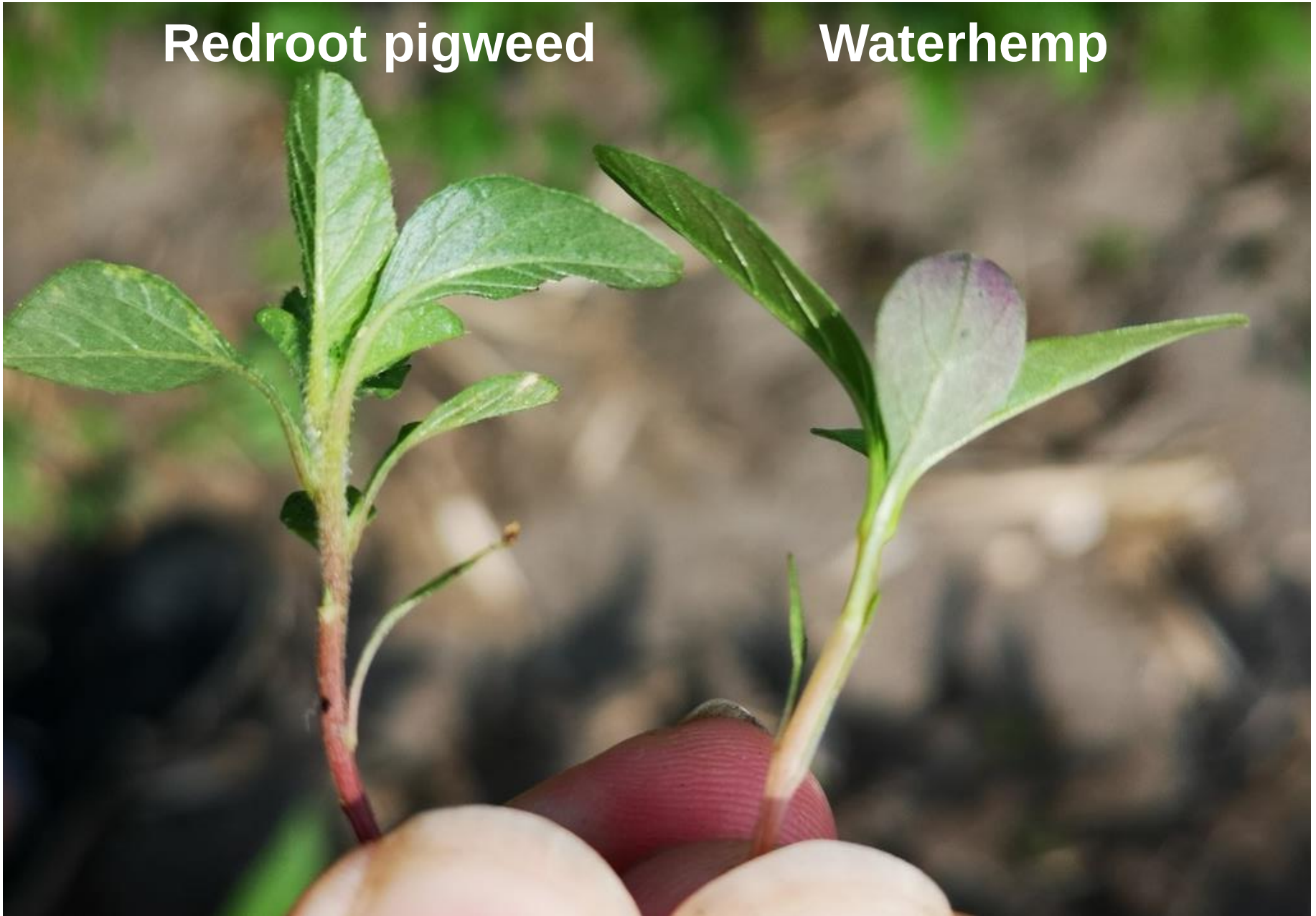
YouTube Video:

Twitter:


- More than 20 plants/square foot can reduce soybean yields by 44%
- Caused an average yield loss in corn of 18% on Ontario farms – up to 84%
- Caused an average yield loss in soybean of 43% on Ontario farms – up to 93%

Q: How many Amaranth seeds are on this dime?
A: ~70 seeds, making finding contamination of crop seed lots a real challenge.

Q: How many Amaranth seeds are in this container?
A: 43,560 – Therefore seed source contamination is a major concern.


Redroot pigweed
Waterhemp

Waterhemp

Redroot pigweed

Amaranth Inflorescence

Waterhemp (Tier 1)

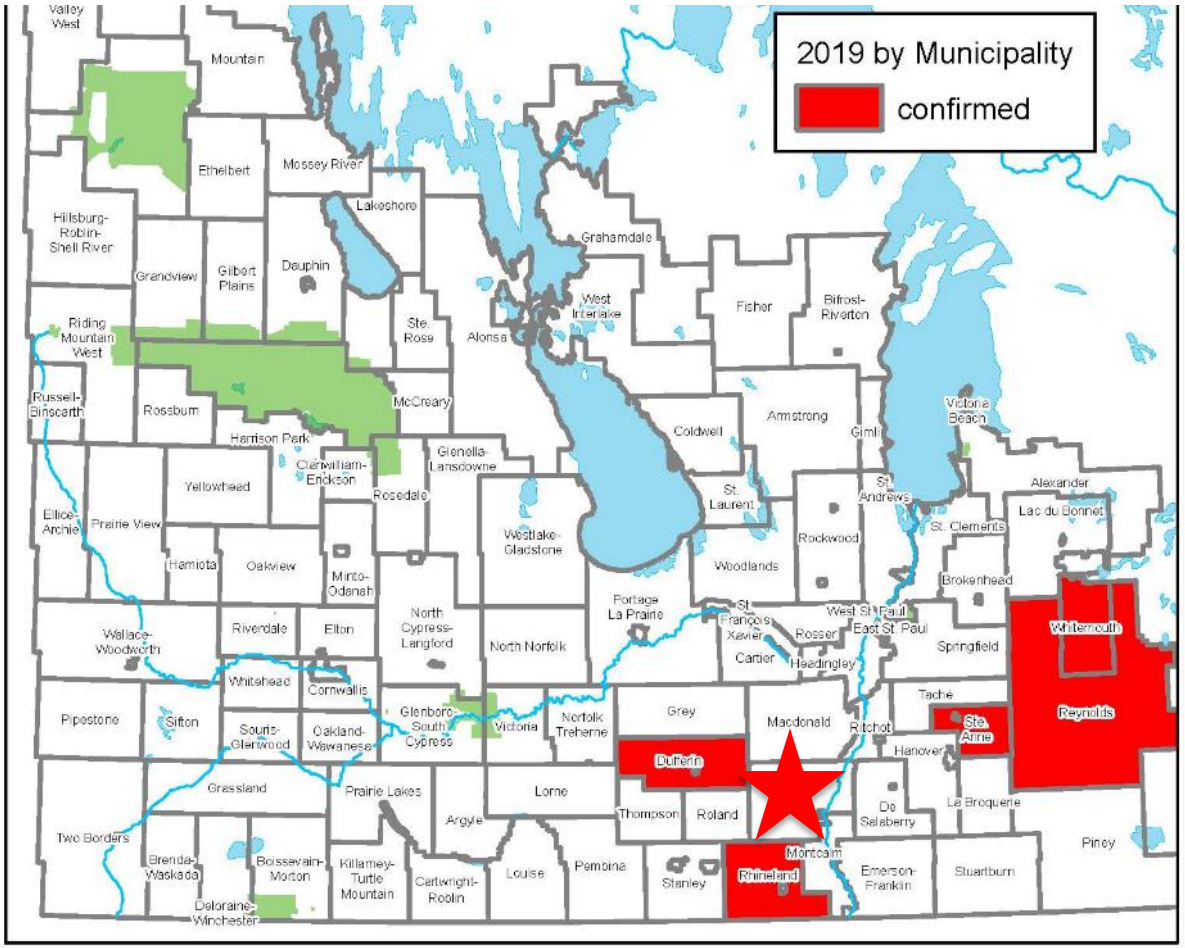
Confirmed HR in North Dakota

- Summer annual, C4
- Dioecious
  - Genetic variability
- Wind dispersed pollen
  - Viable up to 800m, usually <25m
  - Viable seed 14 days after pollination
- Prolific seed producer
  - >1 million seeds/female plant
  - Average 300,000 seeds/female plant
  - germinates throughout the summer especially in reduced-tillage systems
- Relatively short seed longevity
  - Typically <5 years

Waterhemp (Tier 1)

- **Caution:** growth rate is 50-70% greater than many other annual weeds, multiple HR biotypes with Groups 2, 4, 5, 9, 14, 15 & 27
- Identified in 4 RMs in MB in 2019 – suspect Group 2 & 9 (possibly 5)
- **Rapid plant establishment along field perimeters, standing water, and drainage ditches**

Waterhemp Distribution in Manitoba



Manitoba

CANADIAN AGRICULTURAL PARTNERSHIP | PARTENARIAT CANADIEN pour l'AGRICULTURE

Canada

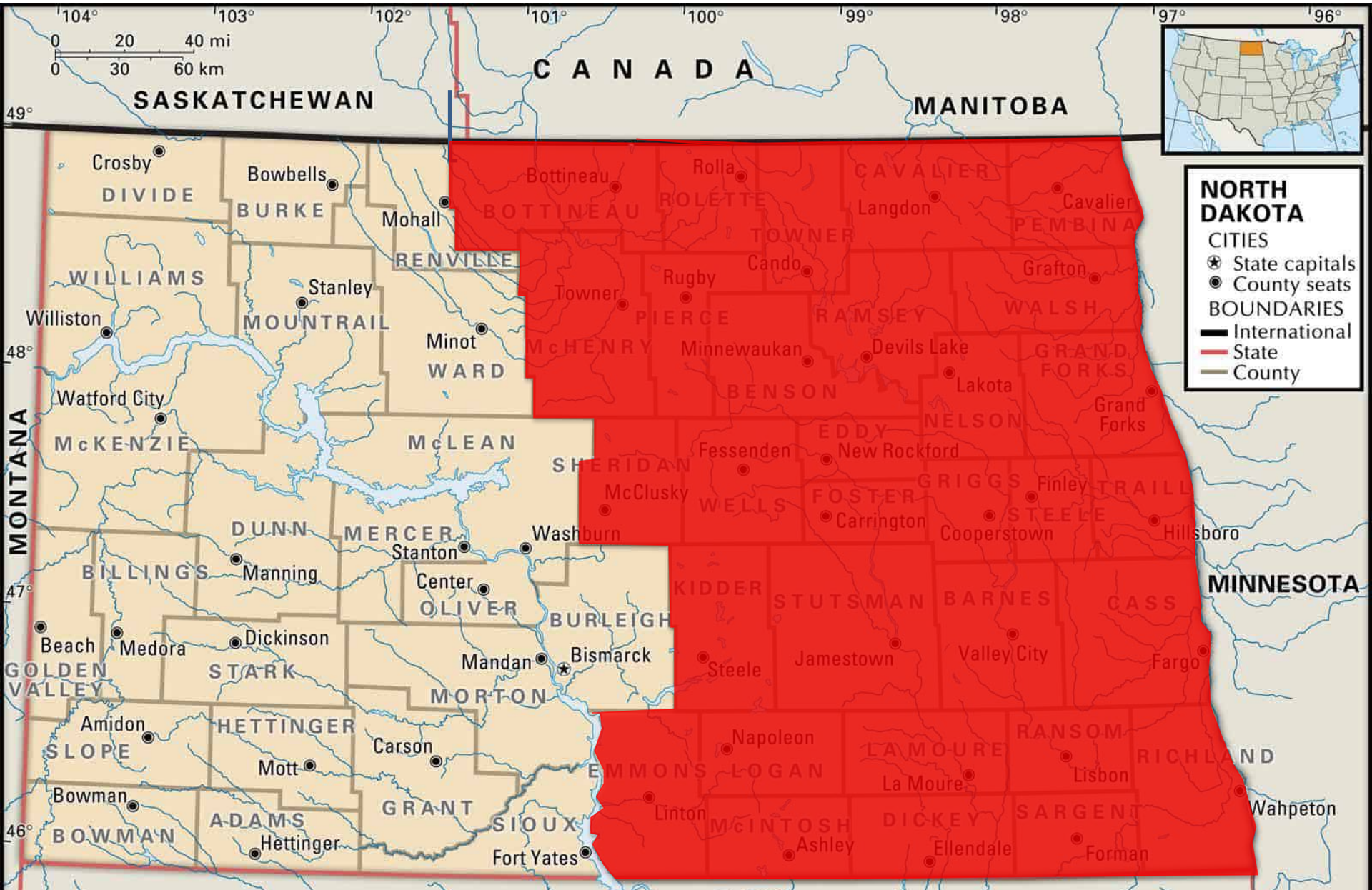
Herbicide Resistance Testing

	Field 1	Field 2	Field 3	Field 4	Field 5	Field 6
Group 2	2/5	4/5	5/5	5/5	4/5	5/5
	1/5 – W574L	0/5 – W574L	2/5 – W574L	0/5 – W574L	4/5 – W574L	5/5 – W574L
	1/5 – S653N	4/5 – S653N	3/5 – S653N	5/5 – S653N	0/5 – S653N	0/5 – S653N
Group 5	0/5	**0/5 - ?**	0/5	0/5	0/5	0/5
Group 7	0/5	0/5	0/5	0/5	0/5	0/5
Group 9	5/5	4/5	5/5	2/5	5/5	5/5
Group 14	0/5	0/5	0/5	0/5	0/5	0/5

The genetic testing for Waterhemp confirmation and herbicide resistance profiles was made possible with the financial support provided by Agriculture and Agri-Food Canada through the Pest Management Centre's Pesticide Risk Reduction Program PMC. AAFC Research Scientists: Dr. Laforest, Dr. Simard, Dr. Nurse and Dr. Page; OMAFRA Weed Management Specialist, Mrs. Obeid and the MAPAQ Diagnostic Lab were integral in the implementation of this project.

North Dakota Distribution

Manitoba



Management

- Crop canopy closure reduces germination/competition from waterhemp.
  - Use of soil residual herbicides/multiple modes of effective action
  - Narrow row spacings
  - Inter-row cultivation
  - Cover crops
  - Increased seeding rates
- crop **rotation**
- machinery **sanitation** to prevent spread
- **destruction** of escaped weed patches
- ON counterparts estimate waterhemp control costs at $45- $60/acre.
- This is why **eradication** of waterhemp is the goal.

And the **law** in Manitoba

Small Weeds = Effective Weed Control

Unemerged waterhemp has 1 growing point to control!

6” waterhemp:
>30 growing points

4” waterhemp:
14-20 growing points

2” waterhemp:
7-9 growing points

Contact herbicides like PPO inhibitors must come in contact with almost all growing points to have effective control of a weed.

Richard Anderson – BASF (Ontario)

2,4-D

- typically has good activity on waterhemp
- staging is important

Shieldex 400SC

- actively growing weeds less than 10 cm tall
- control or suppression

Market Implications

Chem Options:	Your Spray to Swath Interval:
Antler	75 days
Arrow	75 days
Arrow All-in	75 days
Centurion	75 days
MPower Independence	75 days
Patron 240	75 days
Select	75 days
Shadow RTM	75 days
Statue	75 days
Liberty 150 SN	60 days *When Liberty 150 SN 3 is tank mixed with Antler, Arrow, Centurion, Clethodim, Facet L, MPower Independence, Patron, Shadow RTM, or Select, observe a PHI of 60 days from the date of treatment (or last treatment when a second application has been made).*

Market Implications

Liberty 150 SN	60 days *When Liberty 150 SN 3 is tank mixed with Antler, Arrow, Centurion, Clethodim, Facet L, MPower Independence, Patron, Shadow RTM, or Select, observe a PHI of 60 days from the date of treatment (or last treatment when a second application has been made).*

- the decisions that you make on the farm can impact market access for all
- More countries are moving away from internationally recognized standards and setting their own MRLs.
- Customers can detect residues down to parts per billion and even parts per trillion.
- Growers should assume a zero-tolerance policy in cases of missing MRLs
- Pesticide residue requirements change; keep up to date by checking with your grain buyer or referring to the pulse grower advisory on keepingitclean.ca.

Market Implications

- Phytosanitary concerns – manage the risk of introduction/establishment of new weed species
- CFIA maintains a list of export markets with varying regulated/quarantine weed seeds – many are considered “Noxious” in Canada
- Commercially clean grain standards do allow for a certain percentage of weed seeds
- Some importing countries adopt post-entry measures to manage the risk
- RELATIVELY INFREQUENT

How Herbicide Resistance Spreads

How Herbicide Resistance Spreads

Seed recovered from digestive tracts of 526 ducks and geese harvested during a 2 year field study had 35,020 plants emerge. Viability rate and gut retention times indicated potential dispersal up to 2900 km

Conclusions: Study results confirm that waterfowl are consuming seeds from a variety of agronomically-important weed species, including palmer amaranth, which can remain viable after passage through digestive tracts and have potential to be dispersed over long distances by waterfowl.

The Cost of Herbicide Resistant Weeds

- Current year
  - Crop loss from competition
  - Unmarketable product or lower value product (dockage)
- Future
  - Seedbank
  - Land values
  - Complexity of other management strategies

This is after two herbicide applications!!!

4 hours of labour = $200

vs

300 plants x 10,000 seeds = 3 million seeds

NWA Expectations – Tier 1 Weeds

NWA Expectations – Tier 1 Weeds

June 2019

NWA Expectations – Tier 1 Weeds

NWA Expectations – Tier 1 Weeds

The Cost of Herbicide Resistant Weeds

35 acres removed from production

- Seed and fertilizer costs = - $8, 750
- Land rental costs? - varies
- Mowing, tillage etc to keep area weed free - varies

vs

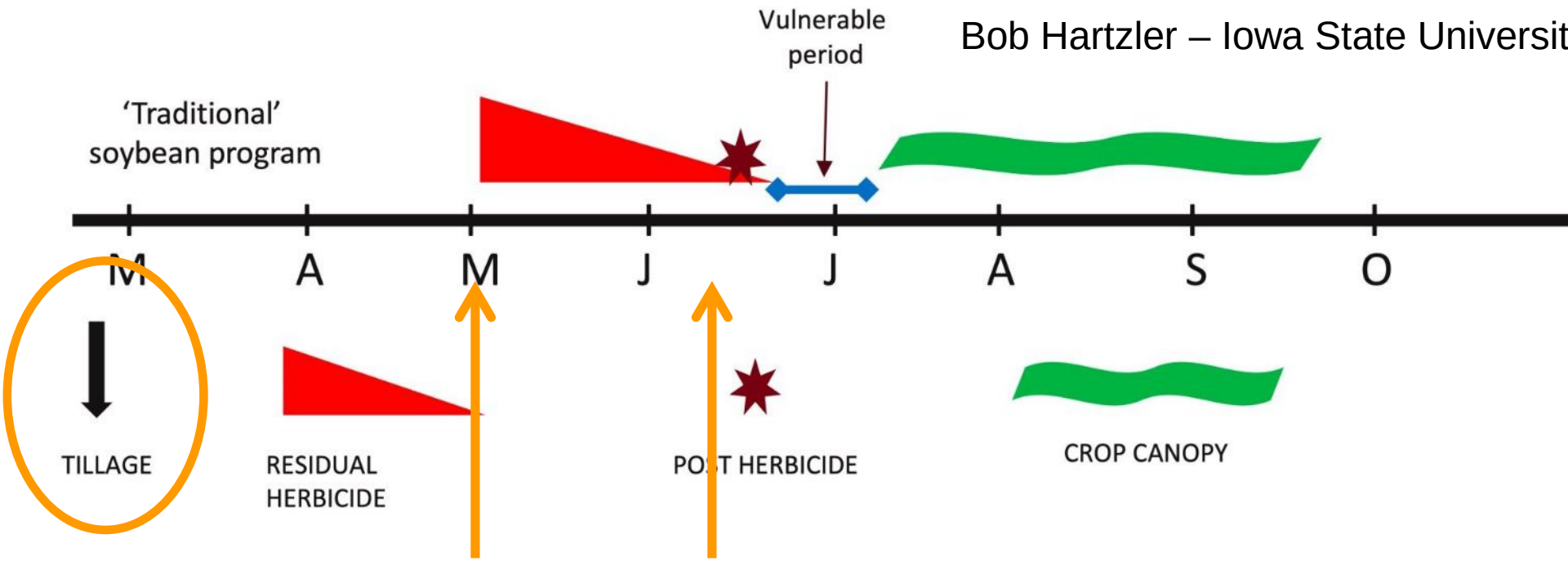
20 plants/ft x 10,000 seeds/plant = 200,000 seeds/ft
x 43 560 ft/acre = 8,712,000,000 seeds/acre
x 35 acres = 304,920,000,000 seeds

Herbicide Layering

304,920,000,000 seeds/35 acres

Layered Residual Herbicides

Objective: Prolong PRE activity until canopy fills



Bob Hartzler – Iowa State Universit

30 billion* **3 billion*** **300 million***

*assuming each weed control tactic resulted in a 90% reduction in the weed population

The Cost of Herbicide Resistant Weeds

- Not easy to manage
- Can cause substantial increases in herbicide cost - $45-$60/ac
- Programs have to be constantly changed due to multiple resistance that will develop over time (not “can”, “will”)
- Trend is for Palmer/waterhemp to develop resistance to any new herbicide sites of action that are used in POST treatments within about 3 (three) cycles of use.

Ohio State University Extension Agronomy Team

Improving the odds

- Australia:
  - Harvest weed seed management
    - Integrated Harrington Seed
    - Redekop Seed Control Unit
    - Chaff cart, chaff lining
- Midwest US
  - Cover crops to enhance herbicide efficacy
    - SARE study showed cover crops provided savings of $27/acre in reduced herbicide applications with similar weed control

Manitoba

Questions?

No pigweed left behind

Go Rogue! Stop the seed

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